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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

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VOL. XXXIX, No. 4. FRIDAY, JULY 28, 1905.

The progress of the block system in America has now reached that encouraging stage where a railroad introducing it issues an illuminated gratulatory circular apprising the public of the fact. The Southern Railway has just done this. The circular has half-tone pictures of a signal, a cabin, a fast train, and other things, and says:

> To accelerate the schedule performance and improve the service of passenger trains we are happy to announce that block signals of the most modern type, have been installed and are now in operation over the entire line between Washington and Atlanta. . . . The block system is also being installed on other parts of the system as rapidly as possible. . . . The most improved interlocking switch and signal apparatus has been installed at passing tracks, yards, and all grade-crossings, thereby greatly facilitating the handling of all trains.

No improvement in American railroad service is a more fitting subject for emulation, and it is to be hoped that many others will appreciate their opportunities as well as has the Southern. When the *Railroad Gazette* began preaching the virtues of the block system, 30 years and more ago, the most that American railroad men did in response to the preaching was to admire England—when they could spare the time from their regular duty of admiring the beauties of the "American despatching system." Then one road introduced the Sykes system, and two or three put in some automatic signals—both kinds being looked upon by most people as luxuries, to be enjoyed only by roads which were both bold and wealthy. The Pennsylvania, meantime, was using the simple telegraph block system, but not saying much about it. After some years of slow progress the Canadian Pacific adopted the space interval throughout its lines, but very incompletely and for passenger trains only. This also was published only in the most modest way; but after many long years it began to be recognized that a road need not wait until it was overcrowded with traffic before using block signals, and progress became quite rapid. One or more roads have on occasion bought whole newspaper pages in which to exploit with more or less close adherence to accuracy their more or less imperfect block signals; and various clumsy artists have illustrated colored folders with fearful and wonderful pictures of semaphores shaped in all degrees of deformity and giving an amusing variety of false indications. Passenger agents have in their admirably refined language told of impossible "automatic switches" with which they hoped to reassure prospective customers.

Looking back on these abortive efforts, the Southern Railway is to be commended for straightforwardness of statement; although the absence of any electrical controlling apparatus on its manual signals leads one to question the propriety of the use of superlatives. From certain comments which have appeared, we judge that some people will find difficulty in reconciling the present statement of the Southern Railway with the statement published in the *Railroad Gazette* for two years past, that that road had block signals on 6,260 miles of its lines; but those people evidently have overlooked the explanatory note which showed that these signals were used only for passenger trains. Moreover, they are used only for rear protection, leaving the chances of having butting collisions as numerous as before, except as the operators, communicating regularly with each other about trains running in the same direction, may thereby be made more careful in guarding against errors in the regulation of opposing train movements. The most hopeful view to take concerning this kind of block signaling is that it is pretty sure, by its satisfactory results, to lead the progressive railroad manager after a time to introduce more perfect methods.

The paper on "Slow Freight Rates in India," by Mr. William A. Dring, General Traffic Manager of the East Indian Railway, printed in this week's paper, brings out strikingly one phase of the evil which results from governmental control of rates. In 1903 there was a railroad mileage of about 26,955 in India, with gross receipts per mile of some £891. The railroads, generally speaking, are the property of the state, and are worked either directly by the state or by companies constituted for that purpose. These companies are paid for their services by means of a small share in the net profits. The way in which the government controls the rate is by laying down maxima and minima, the maximum rate on low-grade commodities being ⅓ pie per maund per mile; or, say, 1.38 cents per ton of 2,000 lbs. per mile. The minimum low class rate is 1/10 pie per maund per mile; say, .42 cent per ton-mile. Mr. Dring's complaint in brief is that the government requires the railroads to charge too much for their own and its own profit, and that the inflexibility of the minimum charge system hurts traffic greatly. On ordinary commodities there is no regular differential treatment of rates; that is to say, there is no graduated reduction, as is the case in France, in accordance with the length of the haul, but in place of this a series of station-to-station tariffs has grown up much as is the case in this country. Coal, however, has recently been given a differential scale, as it is termed. There have been two reductions in the scale of coal rates during the last fifteen years. Before the first reduction British coal was imported in Calcutta in considerable quantities, although coal of good quality was being mined within 130 miles of this port on direct railroad lines; while

such a thing as exporting coal from Calcutta was unknown. In other words, the government deliberately—or heedlessly—throttled its most important traffic by trying to make too much out of it. The solution which Mr. Dring suggests for the future is based partly in the reduction of this minimum rate of the present time, and in part on a differential system. The system suggested is that a line which is cheap to work shall be allowed to charge a lower rate than one which is expensive to work; that is to say, that the minimum rate which may be quoted by the different systems shall be based on operating cost. It is hardly necessary to point out that this is quite at variance with the American idea of a differential between lines. A line which is cheapest to work is apt to have such natural advantages in carrying low class freight that it not infrequently happens that the lines which cost more to work and which cannot give quite so good a service are the ones allowed to charge a lower rate, simply for the sake of getting a share of the traffic which they would not otherwise receive. The discussion leads around to the conclusion, often expressed in the *Railroad Gazette*, that there is no arbitrary, mechanical way of fixing freight rates, and the less restriction that is placed upon those who are concerned with making them, the better the results are likely to be, at least so far as moving traffic is concerned. In Mr. Neville Priestley's report on the organization and working of American railroads, he calls attention to the fact that while he was in this country the rate on grain was reduced from Buffalo to New York (and correspondingly to all other ports) from 4½ to 3½ cents per bushel of 60 lbs., as the traffic could not be moved at the former rate. He argued that this reduction of 1/120 of a penny per pound in the cost of rail transportation could not possibly have affected in any way the price of a penny loaf, yet without it the traffic was at a standstill, and with it some other market was shut out. He added that in India little attention is paid to the effect of rates on foreign markets, and he was under the impression that the grain rates from Delhi to the ports had not been changed for the past fifteen years, the effect of which could be seen in the violent fluctuations which take place in the Indian wheat trade. Mr. Priestley, on another page of his report, contrasted, to the advantage of our system, the American method of making income by small profit per unit and large volume, with that of the Indian railroads, which make their income by large profits per unit and small volume. Both these commentators on the situation in India lay the blame on the inflexible minimum rates established by the government.

THE UNION PACIFIC DIVIDEND.

Twelve years ago the Union Pacific went into the hands of a receiver, and eight years ago passed through foreclosure sale. On Thursday of last week a semi-annual payment of 2½ per cent. on its common stock was announced, which is understood to definitely place the stock on a 5 per cent. basis. In October of 1893, when receivers were appointed for all the roads under Union Pacific control, the Union Pacific system was an unwieldly aggregation of bankrupt railroads operating nearly 8,000 miles of line in what was then the very far West. When the receivership came on, five of the controlled companies, with a total of nearly 2,000 miles of line—the Union Pacific, Denver & Gulf, Denver, Leadville & Gunnison, Fort Worth & Denver City, Kansas City & Omaha, and the St. Joseph & Grand Island—were segregated from the system; the three former to become in 1899 the present Colorado & Southern; the Kansas City & Omaha to be absorbed by the Burlington, and the St. Joseph & Grand Island to remain up to the present time an independent road. The foreclosure sale came in 1897, and in that year the Oregon Short Line was also separated from the system, though with the arrangement that control should remain with the new Union Pacific company. The Oregon Short Line then, as now, owned a majority of the common stock of the Oregon Railroad & Navigation Company. The controlling interest in that company, however, was held jointly by the Great Northern, Northern Pacific and Union Pacific, through control of the preferred stock.

Not only was the old Union Pacific thus split and sundered, but the 1,850 miles of line assumed by the reorganized company were in every respect in thoroughly bad shape. Equipment was out of date and repair; forces were disorganized, and, in particular, the railroad's right of way itself was, as we think of through railroads to-day, practically a railroad only by courtesy. Curves and gradients were almost uniformly severe, rails and roadway were even more run down than is usual after a receivership, and in many cases the original location of the first transcontinental railroad had proved thoroughly unsatisfactory for heavy operation. In 1897 the Union Pacific was more of a possibility than a railroad.

The new management evidently saw clearly the possibilities and knew what makes a railroad. With unlimited faith in the future and an unsparing hand they spent money for improvements. New equipment and new men came to the Union Pacific. The roadway received thorough attention. Between March 1, 1899 and November 1, 1900, there were begun, finished and put in operation nine changes of line, amounting to a practical relocation and reconstruction of the main line through Wyoming. On this section alone, 159 miles of entirely new line were built in the period mentioned. This involved the actual abandonment of 198 miles, or 38 per cent. of the old main line between Cheyenne and Ogden, the saving of 30 miles in distance; of, in one case, 54 ft. to the mile in grade, and of 6,867 degrees in curvature. The system was at the same time expanded by the purchase of a large number of branch lines, many of them without the issue of additional securities, although no provision for buying them was made in the reorganization plan. Between June 30, 1898 and June 30, 1901, the directly operated mileage increased from less than 2,000 miles to over 3,000 miles of line. More than 96 per cent. of the capital stock of the Oregon Short Line had been acquired in 1899 and entire control of the Oregon Railroad & Navigation Company was also secured. The Southern Pacific owned the Central Pacific, which was the Union Pacific's western connection to San Francisco. In 1901 control of the Southern Pacific was acquired. The Union Pacific now owns or controls over 15,000 miles of line. Nor did reconstruction work end with 1901. Since that time similar and more extensive work has been carried on not only on the Union Pacific itself, but on its owned and controlled properties. The famous Ogden-Lucin cut-off is typical of the large expenditures in shortening, straightening and improving the main line.

Dividends were begun in 1898 by a payment of 1½ per cent. on the preferred stock. This was increased in 1899 to 3½ per cent. and in 1900 to 4 per cent., at which rate it has remained ever since. The first payment on the common stock was of 3½ per cent. in 1900, since which time 4 per cent. has regularly been paid on this stock also. Even when the common stock shall be increased to $196,000,000 by the conversion of the total issue of $100,000,000 convertible bonds and regular payments on the mysterious and as yet unissued increase of $100,000,000 in the preferred stock recently authorized shall be called for, the increased rate of payment on the common stock seems likely to be only a step in the upward progress of one of the greatest of our American railroads.

A NEW TRANS-CONTINENTAL COMPETITOR.

According to recent advices, the Tehuantepec Railroad, from Salina Cruz on the Pacific to Coatzacoalcos on the Gulf of Mexico, 180 miles, is about completed, and it is thought that within a year the harbors and wharfage for the landing of steamers and transfer of freights will be finished. Mr. E. L. Corthell described the interesting history of this project and gave an account of the building of the road in the *Railroad Gazette* of July 15, 1904. After a series of vicissitudes and many years of inaction following the early efforts to build a railroad across the Isthmus of Tehuantepec the Mexican Government entered into a partnership contract with T. Pearson & Sons of London in 1898. This contract was amended in 1902 and the partnership was given the name of the National Railroad Company of Tehuantepec. The contractors are the administrators or managers of the company's affairs. They believe that the Tehuantepec route will be in complete operation fully eight or ten years before the Panama canal can be, and they expect it to have an important part in reducing the time of slow transcontinental freight, some of which now goes by rail, some via Panama, and some through the Straits of Magellan.

Announcement has just been made that the American-Hawaiian Steamship Company, now operating a fleet of steamships from San Francisco and Hawaii to New York through the Straits of Magellan, has concluded a contract with this Tehuantepec road for the operation of connecting steamship lines on both the Pacific and Atlantic sides, and will use the seven vessels now operated in its service in addition to two new ships about to be built. The company expects to afford a service of 25 days by the new route as against the 35 or 40 days now taken to transport freight between New York and San Francisco by way of Panama and approximately three weeks for slow freight by rail lines across the continent. (The average time by the Southern Pacific, which trans-ships into steamers at Galveston, is in the neighborhood of 17 days.) In view of

this interesting development it is worth while to review the general situation as regards transcontinental freight at the present time. By a rough esimate, which is probably not far from correct, about one-eighth of the total freight business of the Atchison, Topeka & Santa Fe is trans-continental, and presumably some such proportion would apply on the other main trade lines across the continent. Without attempting any close calculation where no statistics are available, it may be that 10,000,000 tons of freight are hauled between the Pacific coast and the East (the Mississippi river, or points east of it) every year. Citrus fruits constitute the largest single item of trans-continental freight, though they do not predominate against the field. This kind of traffic, of course, will always go by rail, together with a great amount of other freight that is urgent or valuable. The average time for through freight from San Francisco to Chicago is in the neighborhood of eight days for perishable goods of this class, and the railroads need never fear the competition of the Panama canal or any other water route or part water route on a good proportion of the trans-continental business that they do. So far as slow freight is concerned, there has always been water competition around the Horn and through the Straits of Magellan, while the Panama Railroad has also carried a small share; but as the entire business of this road in 1903 amounted to less than 350,000 tons, it is evident that it has needed but little consideration in the past. Whether or not it had special inducements to keep its freight rates high is a disputed point.

For some time there have been three steamship services from New York to points on the west coast of South America. One of these, the American-Hawaiian Steamship Company, already referred to as the holder of the new contract, has despatched its steamers, which our shipping laws require to be American, from New York through the Straits to San Diego, San Francisco and Honolulu. The service has been approximately monthly in each direction. Two other lines, known respectively as the Merchants' Line and as the West Coast Line, send steamers from New York around to Chile, Peru and Ecuador through the Straits. From New York to Punta Arenas in the Straits of Magellan, by the most direct navigable route the distance is not far from 6,390 nautical miles, and from Punta Arenas to Guayaquil, Ecuador, is 3,316 nautical miles, while San Francisco is 3,608 miles beyond Guayaquil. Including sailing vessels, probably half a million tons, at the very outside, covers the sea-borne freight per year. That for San Francisco has to traverse approximately 13,300 miles in its journey from New York, and the trip takes upwards of two months, at best. By the Panama route, the total sea distance is 5,200 miles; by the Tehuantepec route, it is 4,290. The Tehauntepec Railroad, therefore, feels that it can compete for rail freight, for Straits freight and for Panama freight bound from the Atlantic coast to the Pacific coast of North America, besides the freight which formerly rounded Cape Horn on its way from west American and Oriental ports to Europe. This project has attracted comparatively little attention during the Panama agitation, but the recent notice of the ship contract shows that the Mexican route is about ready to begin operations, and to demonstrate whether or not the great hopes of its promoters are going to be realized, in whole or in part.

The war in passenger rates eastbound from Chicago which was begun by the reduction of $2 in the first class fare through to New York by the Michigan Central, does not progress with great speed, but it seems to be characterized by considerable persistency. Following the reduction from $20 to $18 by the Michigan Central the Grand Trunk made the rate $16. The M. C. then took off $2 more and now the Grand Trunk announces a rate of $14. The other differential lines follow each move, more or less closely. The reduction has now become so large that unless some one of the principal participants is bold enough to call (and actually secure) a prompt conference, serious demoralization is likely to ensue; for passengers from all over the country west of Chicago will want to take advantage of the saving, and the work of restoring the rates will be slow and difficult. The scalpers, too, will be likely to come in for a share of the spoils. When rates are changing every few days the passenger manager who refrains from calling these lawless outsiders to his aid must have a rigid backbone. Why the Michigan Central ever started this contest is somewhat of a mystery to the outsider. The arbitrators very wisely published nothing about their reasons for deciding in favor of a reduction, and nothing has been given out except that the Detroit ferry is a hindrance to first class service. It is no worse hindrance, however, than it has been for the past 50 years. The Michigan Central may have lost business because of the opening of the Wabash line to Buffalo or because of the through car arrangements of the Lehigh Valley, and other improvements which have favored other lines between Chicago and Buffalo; but why should these other lines now be made to reduce fares on this new business that they have got, as a penalty for having got it? Probably they can reply to the Michigan Central's appeal with the assertion that the passengers lost by it have been taken largely by a competitor in its own household—the Lake Shore—but whether that will have any weight with an arbitrator, is another question. Evidently it has thus far had no weight at all. One of the reasons mentioned by the reporters for making the Michigan Central a differential line is the fact that the Pennsylvania has a differential line between Chicago and Pittsburg—the Pan Handle; but with the Nickel Plate the New York Central now has two. Fortunately, the discussions and negotiations thus far—that is say, the arbitration proceedings—have not broken the law (though they were intended to regulate competition) for they have resulted in some benefit to the dear public; but when the time comes for restoration, look out for the Sherman law!

NEW PUBLICATIONS.

Plumbers' and Fitters' Pocketbook. A Reference Book on Plumbing, Steam Heating, Hot Air Heating, Hot-Water Heating, Ventilation, Gas-Fitting, Drainage and Sewerage. Scranton, Pa.: The International Correspondence Schools. 1905. Leather, 375 pages.

This little book, the first of the sort to be published, will undoubtedly fill a long-felt want in the field for which it is intended. The publishers explain that they have not tried to produce a condensed encyclopedia of the art and practice of the subjects dealt with, but have striven to anticipate the daily wants of the user and to give the information in the manner best suited to his needs. As an evidence of the care employed in doing this, wherever a rule, formula or process is given, only one is presented and not several from which to select, which often confuses the user. Of course, in each case of this sort whatever formula, etc., is given is the one which in the judgment of the compilers is the best suited to the needs of the case.

The first quarter of the book contains engineering data of the sort usually found in all such reference books. The rest of the book is about equally divided between heating and ventilation and plumbing. Both sections contain a large amount of useful information, concisely presented, but simple, and fully illustrated where necessary. The index is quite complete, covering 44 pages.

TRADE CATALOGUES.

The General Railway Signal Company, of Buffalo, N. Y., has issued a new catalogue and price list of electric interlocking, much larger and more elaborate than anything published by the company before. It is a book 6 in. x 9 in., of 314 pages, and everything made by the company, in the department named, is illustrated to the last detail. The descriptive matter contained in the company's first catalogue is omitted, the editor assuming that the principles of electric interlocking are now familiar to engineering and railroad men. The order numbers, which run from 02 to 18,003, are indexed at the end of the book, and there is also an index to pattern numbers with the corresponding order number. Electric interlocking is now in use on 41 different American roads, and a list of these roads is given. The Atchison has 16 plants; the Baltimore & Ohio, 15; the Lake Shore, 15, and the Southern Pacific, 10. The number of all-electric plants installed or contracted for in the United States in 1904 was 80; this was more than twice the number installed in any preceding year, and the same is true of each year's output since 1900.

Industrial Locomotives.—The Davenport Locomotive Works, Davenport, Iowa, is publishing a series of pamphlets describing the industrial locomotives which it makes. Two already have been issued, being devoted to Forney rear tank and to saddle tank types respectively. The pamphlet gives, in addition to an illustration and the principal dimensions, the tractive power and the hauling capacity on different grades. There will be about 12 pamphlets in the series and they will be furnished to any one interested in the subject with which they deal.

Concrete.—The Municipal Engineering & Contracting Co., Chicago, sends an interesting pamphlet entitled "Instructions to Agents." This pamphlet was published for distribution among the company's agents, so that they might be better prepared to talk to prospective buyers of the "Chicago improved cube concrete mixer." It explains in detail the construction and operation of this mixer and also gives interesting data in regard to concrete work, including figures as to approximate and actual cost of concrete per yard as made under varying conditions.

Ideal Power, the monthly magazine of the Chicago Pneumatic Tool Co., has for its leading articles this month "The Erection of the New Amsterdam Theatre, New York," "A Million Volts Current," being an account of the passage of electric currents of high

tension through the bodies of experimenters; "Industrial Europe," the second installment of a series by Lieut. Godfrey L. Carden, and "An Electrical Giant," which is a mammoth lifting magnet exhibited at the recent International Electrical Exposition in Boston.

Steam Turbines.—The De Laval Steam Turbine Co., Trenton, N. J., sends an interesting pamphlet descriptive of the De Laval steam turbine. A brief sketch of Dr. De Laval, the inventor of the turbine, is given as well as numerous views taken in the company's shops and offices at Trenton.

Renold Roller Chain.—The Link-Belt Engineering Co., Philadelphia, Pa., sends an interesting catalogue and price list of its "Renold" roller chain. Detailed illustrations showing the construction of the chain are given and the advantages to be derived from its use are tersely explained.

Pneumatic Hammers.—The Ingersoll-Sergeant Drill Co., New York, sends its catalogue, Form No. 6, which describes and illustrates in detail the Haeseler "axial valve" hammers, made by this company.

Springs.—The American Spring & Supply Co., New York, sends a neat little folder descriptive of its springs, including extension, compression and tension springs of all descriptions.

CONTRIBUTIONS

Disadvantages of the Railroad Clearing House Plan.

Chicago, Ill., July 23, 1905.

To the Editor of the Railroad Gazette:

The accounting officers of American railroads being familiar with clearing house needs and practices, and also with our method of settling interline accounts, thought that it was only necessary to explain the latter to demonstrate the uselessness of the former; that a clearing house would be at once an expense and a hindrance. It seemed to them to be only necessary to explain the simplicity, economy and effectiveness of present methods to demonstrate the inadvisability of any change. Hence the paper prepared by the American Railway Accounting Officers at their recent meeting in New York. Argument appeared to be unnecessary. The proposition of a clearing house was as if a specialist, looking for something to do, should propose to operate on a man in robust health. The accounting officers naturally thought it was only necessary to point out that the railroads were sound in both body and method, and needed no doctoring. They, therefore, caused to be prepared a clear and concise statement of the manner of settling interline accounts between railroad companies.

No advantage, it is apparent, either great or small, can be gained by the institution of a clearing house—or rather, a group of clearing houses; for it would manifestly need several, for the results of their work would have to be consolidated in still another or central clearing house.

The paper of the American Accounting Officers puts the case concretely, and in doing so demonstrates that a system of clearing houses is unnecessary in America and would occasion delay in the adjustment of accounts and, by duplication of work, long distance correspondence, and other hindrances add greatly to the present cost. It is impossible to point out a single advantage that clearing houses would have over present methods. The errors and omissions that have to be adjusted in settling interline accounts now occasion no delay or inconvenience in arriving at cash balance, as the companies interested have all the original records and facts at first hand to enable them to quickly right inaccuracies or omissions in their reports to each other.

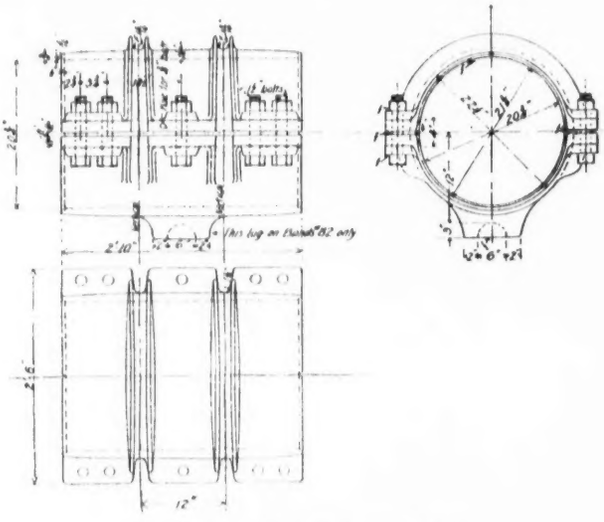
Balances (i. e., amounts due the creditor company) are based on the original statements exchanged between the railroads, and sight drafts are at once made therefor. If there are errors or omissions they are pointed out to the company at fault and the amount is added to or deducted from the next month's return. And while settlements between railroads are now made monthly they may be made daily or weekly if desired, with little or no additional expense.

It is obvious that if we had clearing houses the same returns would have to be made thereto that are now made to the companies interested; and with the same attendant errors. To correct the latter much long distance correspondence back and forth by the clearing houses would be required, involving interminable delay and expense. And if balances were not paid by the central clearing house until all the accounts were settled (so that one check would suffice as claimed) the railroad companies would not get what is due them for a year or more after the month's business was closed. As it is now, balances are struck as soon as the accounts are exchanged and the creditor company makes draft for the same. Thus, to illustrate, the accounting officers of the Burlington or North-Western collect, within 30 days, all balances due their companies for freight, tickets, extra baggage, car service and other interline accounts, and at a cost not to exceed $12 per month! On the other hand the correspondence and multiplicity of reports that would intervene if the work were done by clearing houses in settling the vast and intricate interline accounts of these companies would exceed such sum a thousand times, to say nothing of the delay and entanglements that would arise from the absence of original records and personal knowledge of the facts.

The paper prepared by the Association of American Railway Accounting Officers, referred to above, explains clearly the present method of settling interline railroad accounts. It shows, incidentally, that clearing houses are unnecessary and would involve not only great delay in settling cash balances but add immensely to the cost, to say nothing of the inconvenience and embarrassment to the companies interested of having their affairs taken out of their hands and delegated to third parties acting arbitrarily and in a purely perfunctory manner. Railroad Accounting Officer.

Cables for the Manhattan Bridge.

The Department of Bridges of the City of New York has issued the contract drawings and specifications for the superstructure of the Manhattan Bridge over the East river, connecting the boroughs of Brooklyn and Manhattan. This bridge, which is sometimes known as No. 3, is located between the Brooklyn Bridge and the Williamsburg Bridge, about a half a mile upstream from the former. The foundations for the piers are completed and work on the anchorage masonry is under way. It will be remembered that the original plans for this bridge contemplated the use of wire cables but former Bridge Commissioner Lindenthal caused a new set of plans to be prepared in which nickel steel eyebar cables were to be used. A change of administration in the city government, however, prevented him from carrying out such a method of building the bridge. There was a wide difference of opinion among prominent engineers as to the practicability and advisability of employing steel eyebar cables in a structure of such size, although it was pretty well established that it was possible to do it safely. The present Bridge Commissioner, Mr. Best, on taking office, threw out his predecessor's plans and had the department engineers finish the original plans



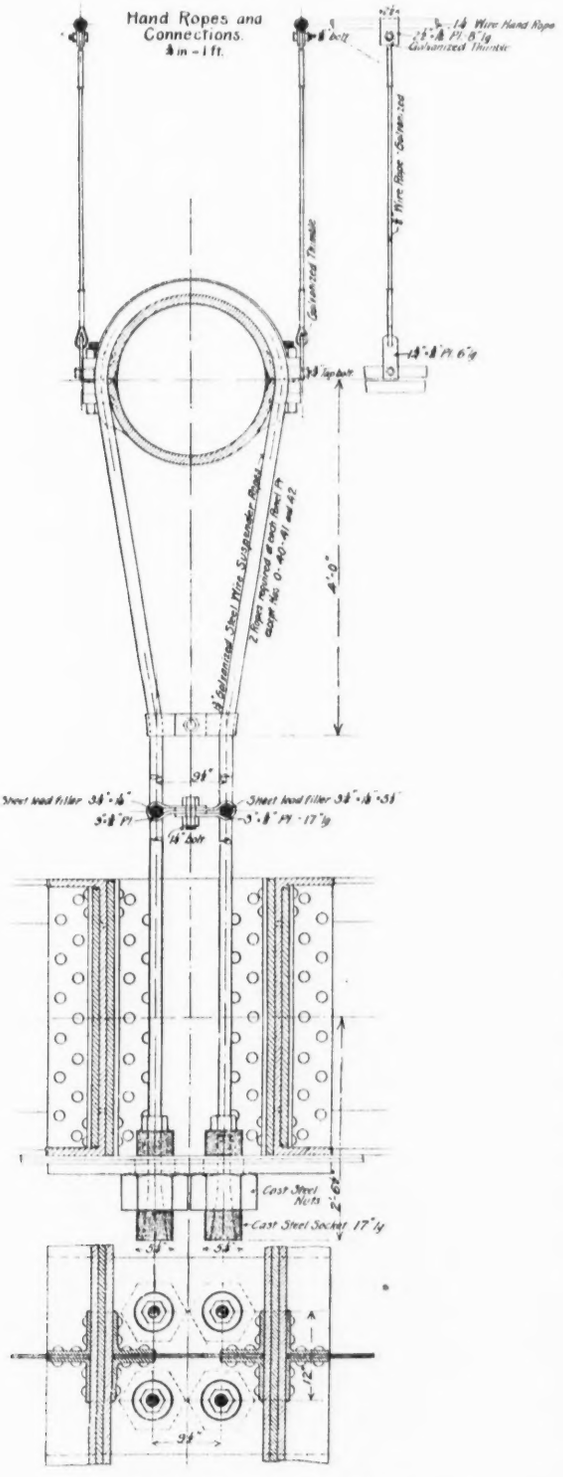
Cable Band for Manhattan Bridge.

which called for wire cables. In the *Railroad Gazette*, July 1 and December 16, 1904, were published drawings and descriptions of the architectural features of the new bridge and the masonry for the anchorages. The accompanying drawings show some of the details of the cable connections and suspenders.

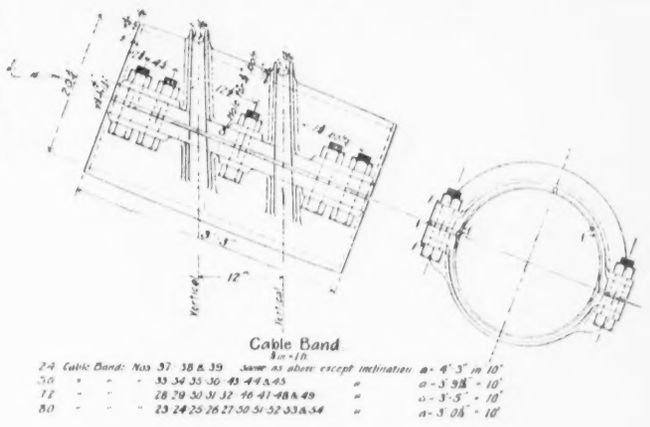
There will be four main cables approximately 20¾ in. in diameter. Each cable will consist of 37 strands and will contain 9,472 parallel wires .192 in. in diameter before galvanizing. In the operation of cable making each strand will be built several feet higher than its final position when laid in the cable. This will be accomplished by placing the shoe at each end of the strand a fixed distance back of its final position in the anchorage and also by carrying the strand on sheaves above the grooves of the cable saddles on the tops of the towers and at the anchorages. When the strand is finished it will be lowered into the saddle grooves, the shoes will be placed on the permanent pins at the ends of the anchor chains and the strand will then be adjusted to its proper versed sine by means of

fillers between the shoes and anchorage pins. When all the wires of a strand have been laid in place and before the strand is placed in its final position in the cable, it will be bound together by bands to keep the wires in their proper position parallel to each other. These bands will be composed of five or six turns of No. 10 wire securely locked and will be placed at intervals of 5 ft.

As the cables of this bridge will be much larger than any previously built, it will be necessary to assemble the strands in groups. The seven strands forming the center of the cable will be consolidated into a core cable by removing the temporary wire bands on each strand and squeezing the wires of these core strands together with heavy pressure bands and then winding this core with several turns of No. 16 plow-steel wire at intervals of 10 ft. The twelve strands next outside will then be assembled uniformly around the core cable and rounded and compacted about the core with pressure bands followed by wrapping at intervals to preserve the shape. Finally the remaining 18 strands will be assembled about the enlarged core and securely wrapped with No. 8 wire at intervals of 4 ft. When each cable has been fully compacted and banded, the cast-steel suspender bands will be accurately placed and thoroughly clamped on the cables. Before bolting on the cable bands, the cables



Suspenders and Connections.



Cable Band for Manhattan Bridge.

under the bands will be thoroughly cleaned of oil and will receive a thick coat of red lead paste.

The final protecting covering of the cables will consist of a continuous serving between the cable bands of galvanized round Norway iron wire applied under stress immediately following a thorough squeezing of the cables into compact cylindrical form by powerful clamps. This serving wire will be No. 9 gage before galvanizing. The wire wrapping will extend under the ends of the cast-steel cable bands counterbored at each end to receive at least two complete turns of the wrapping wire which will be secured under the bands in a suitable manner. The ends of the cable bands will then be made water-tight by caulking around the wrapping under the counterbore with lead and oakum or by pouring this joint with molten lead. After the wrapping is applied and the cables, suspenders, hand rail ropes and fastenings are completed they will receive one coat of red lead paint. The final serving of the cables will not be started until after the suspended superstructure is completed and most of the dead load is applied.

The following extracts from the specifications for the steel cable wires are of interest:

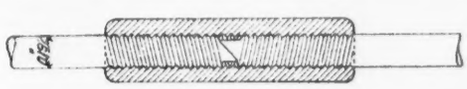
All steel for wire for the cables, suspenders and hand ropes shall be made in an open-hearth furnace lined with silica. The serving wire shall be of Norway iron.

No portion of the pig iron or acid open-hearth scrap stock used in the furnace shall contain more than .06 phosphorus or .04 sulphur. Ladle tests from the furnace shall meet the following chemical requirements: Carbon not to exceed .85 per cent, manganese .55 per cent, silicon .20 per cent, phosphorus .04 per cent, sulphur .04 per cent, copper .02 per cent.

At least 30 per cent. of the top of the ingot must be discarded to insure sound material and the billets rolled from the ingots shall be cut in uniform lengths weighing not less than 350 lbs. each.

The wire for cables, hand ropes and suspenders shall have an ultimate strength of not less than 215,000 lbs. per sq. in. before galvanizing and an elongation of not less than 2 per cent. in 12 in. measured while the specimen is in the testing machine. The bright wire shall be capable of coiling cold around a rod 1½ times its own diameter without sign of fracture. The cable wire before galvanizing shall measure .192 in. in diameter and shall not vary in gage more than .003 in. After galvanizing, the steel wire shall have an ultimate strength of not less than 200,000 lbs. per sq. in. of gross section. No machine straightening of wire will be allowed.

The cable wires shall be spliced as shown below. The splice



Wire Splice, Full Size.

shall have a strength of at least 95 per cent. of the ultimate strength of the wire so that it will resist any tendency to part during the operation of cable making. The splice consists of a sleeve ⅜ in. in diameter, with right and left-hand threads, the wires for shop splices having cold-rolled threads and mitered ends for locking the splice. All splices shall be carefully soldered. All field splicing of wires shall be done with thread cutting dies.

The suspenders shall be 1¾ in. in diameter and weigh not less

than 5.1 lbs. per lineal foot. They shall be composed of six strands of 19 wires each laid around an independent wire rope center consisting of 49 wires, left-hand lay. The suspenders shall preferably be of long lay.

The galvanizing shall consist of a coating of zinc 99.75 per cent. pure containing not more than .03 per cent. of iron. It shall be applied evenly in a molten state.

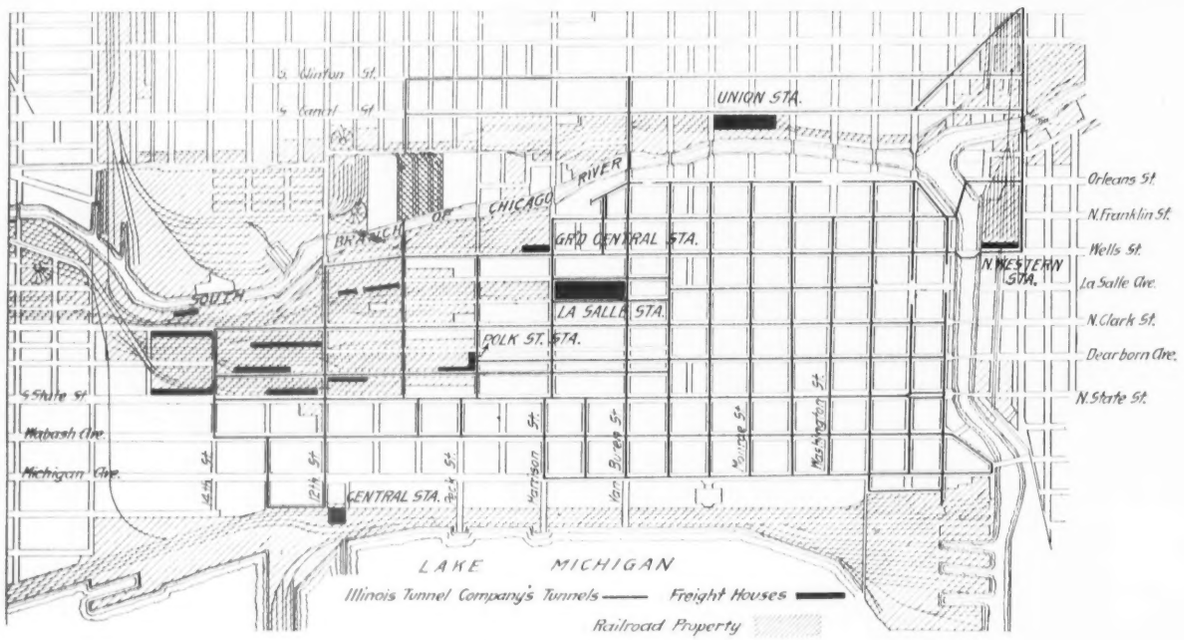
The maximum unit stress on the main cables under dead load, temperature stress, and congested live road will be 73,000 lbs. per sq. in., and in the suspender cables, 30,000 lbs.

The Chicago Freight Tunnels.

In the *Railroad Gazette* June 2 an account was printed of the remarkable circumstances that attended the construction of the Chicago freight tunnels, together with the tangle involved in securing their rights and franchises. The author called attention to the fact that down-town Chicago, with a tremendous wholesale and retail business, is but eight blocks wide by ten blocks long, while every outlet from this congested territory is blocked by the lake or by the interwoven system of railroad tracks.

The accompanying map gives a clear idea of the location of these freight tunnels. The dimension of the tunnels is 6 ft. x 7½ ft., and they gridiron the down-town district, running beneath practically every block, with cross-over curves at each intersection. About 32 miles of this unique system has now been completed and the scheme as a whole is about ready for operation, although the company intends to continue making extensions as needed, especially in anticipated. The operation in this respect will correspond more to that of street cars in the crowded portion of a city than it will to conditions on steam railroads. The entire system is, of course, single track, but certain stretches are to be always used for traffic in certain directions; and there are no sidings, except spur tracks built to reach stores and commercial establishments at points along the line. The company sees no particular limit to the number of these stub tracks that can be built. The different sections of the tunnel system are named for the streets under which they run and little bronze signs are placed at each corner. Except for this it would be very easy to become lost in the tunnels, as there are practically no landmarks, and all portions of the line are substantially uniform. There is one extremely small hill where two portions of the line were joined with a slight inaccuracy in calculation. Except for this the entire system is flat as a table.

Chicago was peculiarly well adapted to an enterprise of this sort; first, because of the nature of the ground to be excavated, which was simply firm clay without any rock or sand, and, second, because of the concentration of the industry of the city into such compact area as compared with other cities. It would be presumably quite impracticable to build any such system of tunnels through the rock of New York; and, apart from this physical difficulty, it will readily be seen that the lines would have to reach as far south as the Battery; would have to traverse the wholesale district west of Broadway, extending certainly as far north as Fourteenth street, and then would have to connect with freight yards all along the river front. In Chicago this problem is greatly simplified and there is no apparent reason why the freight tunnels cannot accomplish



The Chicago Freight Tunnels.

the way of stub tracks to large commercial houses. As described by the author of the previous paper, the purpose of this tunnel system is to carry freight from all the business houses direct to the railroad terminals. Elevators are to be put in at all railroad stations, and business houses that have a good deal of shipping to do will either use elevators or will build their basements down to connect with the tunnels, so that the cars can be loaded without loss of time. Where elevators are used, the cars are run right on the platforms and hoisted up to the desired level for loading.

The company has been making experiments with its rolling stock. At present it has not much on hand and is not sure where it will be kept, although one or two localities have been considered for storage yards. Five-ton electric locomotives are now the standard, but only a few have been built. The General Electric and the Jeffrey Companies have built the ones on hand so far. The locomotives correspond in general to those used in mines, taking their power from an overhead trolley wire and not from a conduit between the rails, as was stated in the previous paper. The height of the tunnel (7½ ft.) is such that there is no danger of workmen coming into contact with the live wire. The track gage is two feet.

It is proposed to run a slow service, by sight and hearing, as one of the company's officers expressed it. There will be no signals, at least for the present, and all the switches at the cross-over tracks will be worked by hand. The tunnel is brilliantly lighted with incandescent lights, and with cars running at a speed of three or four miles an hour, no trouble from collision at the numerous crossings is wonders in the expedition of freight, entirely apart from their service in reducing the congestion on the streets. Just what proportion of the present heavy trucking they can do away with, cannot at present be estimated, but it seems logical to suppose that this proportion will be a large one.

The names of a number of railroad officers appear on the directorate of the company. It is understood that the stock has not been subscribed by the railroad companies direct, but rather by certain large owners of their stock. The Tunnels Company was anxious to have these names on the directorate to promote a spirit of mutual helpfulness, for without the co-operation of the steam railroads the work of the tunnels would amount to but little. No arrangements have as yet been perfected with regard to the scale of charges for carrying freight in the tunnels. The present intention is to charge about the same as the surface teaming companies do, although the development of faster and better service in the tunnels than is possible on the surface may perhaps enable a somewhat higher rate to be charged.

It is expected that a beginning will be made of using the tunnels for commercial purposes in about three months. At the present time, while arrangements are being perfected, the completed part of the system is used only to haul excavated material to the lake front.

The work of finishing the Simplon tunnel so that the trains may run through progresses slowly, great obstacles having been

met. The temperature of the rock where work is going on is 115 deg. It had been hoped that trains might run through next October; but now it is believed that it will not be till December, or perhaps later.

Bascule Bridge of the New Orleans Terminal Company.

The New Orleans Terminal Company recently completed across New Basin canal, New Orleans, a bascule bridge of the type shown by the illustrations. It replaces an old wooden drawbridge long used at that point. The bridge is a double-track through plate-girder design, 69 ft. $11^{1}/_{16}$ in. center to center of bearings and 71 ft. $11^{1}/_{16}$ in. end to end of girders, the depth of girders being 9 ft. ¼ in. back to back of angles. They were designed in accordance with St. Louis & San Francisco 1902 specifications, which are based on a loading of two consolidation locomotives carrying 180,000 lbs. on drivers, followed by 4,000 lbs. per lineal foot of track.

Each girder pivots at its inner end on a 7-in. pin, with bearings in a built-up shoe 5 ft. high from base to center of pin, and 4 ft. x 3 ft. 9 in. at the bottom. Each shoe is anchored to the pier by eight bolts 1¼ in. in diameter and 1 ft. 6 in. long.

The tower is 104 ft. high to center of top sheave, 31 ft. wide, c. to c. of posts, and 68 ft. 8 in. long c. to c. of bearings. Pier No. 2, which is the center pier of the structure and 16 ft. wide, carries the pivot end of the bridge and the adjacent columns of the tower. These columns are latticed members formed from 15-in., 33-lb. channels. The construction of the tower is clearly shown by the drawings.

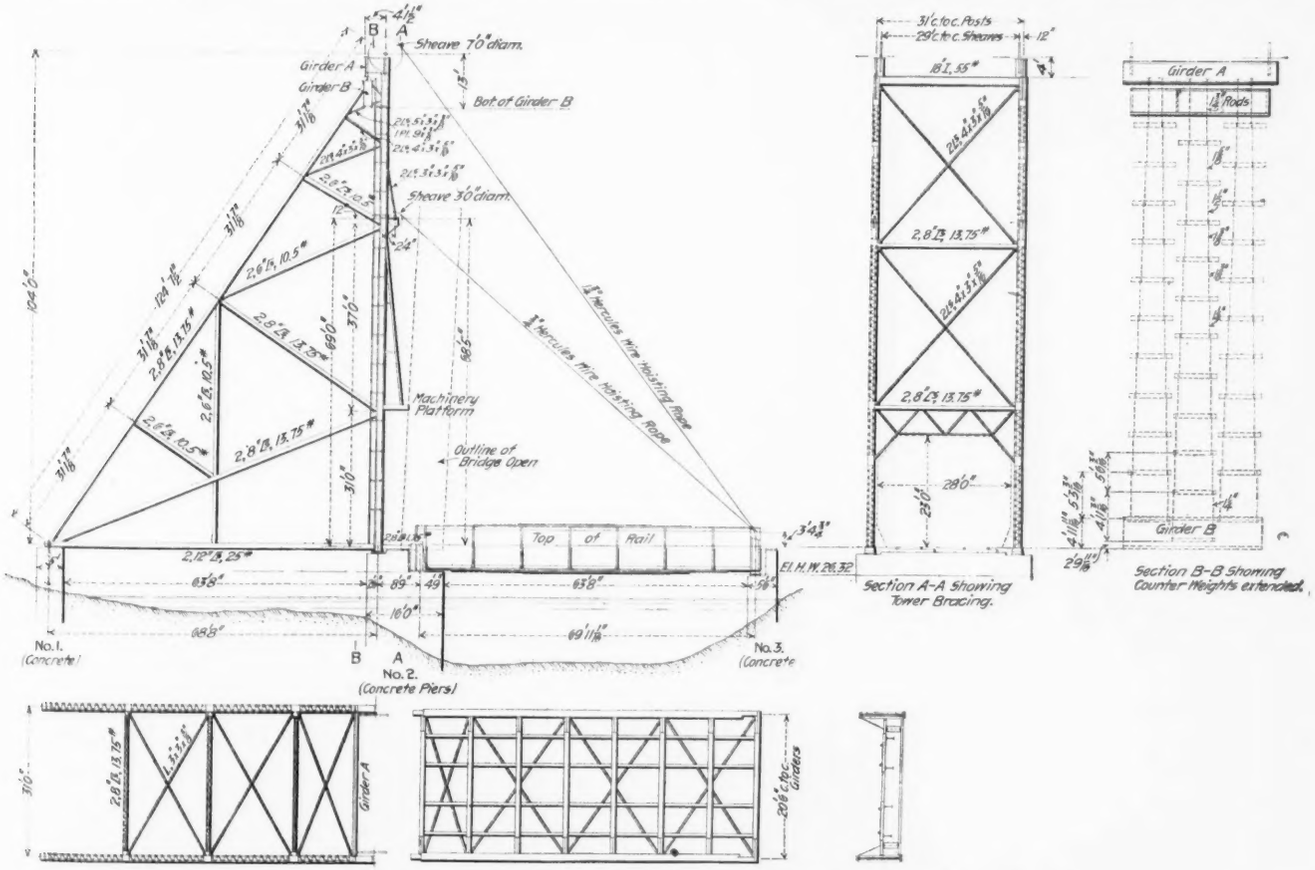
The counterweight system of the bridge is one of its most interesting features. It is arranged to take 90 per cent. of the weight of the bridge in any position, leaving 10 per cent. to be carried by the ¾-in. hoisting cables. The box girder "b" seen at the top of the tower in the general elevation, is suspended from the 1¾-in. cables passing over the 7-ft. sheave. In this position of the girder, corresponding to the closed position of the bridge, it holds three sets of 10 weights each, the weights being of special form and arranged for those of each set to nest one on another. They weigh approximately 3,000 lbs. each. When the bridge is in the raised position, girder "b" is at the bottom of the tower and the system of counterweights is extended in three rows as shown in one of the views (Section B B). It will be seen that the weights in each row are suspended serially, each from the one above, by short rods. These rods have each a conical lug on the bottom to support the weight when it reaches that position. The top pair of rods for each row is attached to girder "a" at the top of the tower. It is therefore evident that in the "open" position, with the weights extended, they are supported entirely from girder "a," exerting no effect on the bridge. As the latter closes, girder "b" rises, picking up the weights and thereby automatically increasing the counter-

New Orleans Terminal Co.'s Bascule Bridge over New Basin Canal.

weight as the bridge approaches nearer and nearer to the horizontal; the maximum being reached with the bridge closed an all of the weights collected in girder "b" at the top of the tower.

The hoisting machinery is driven by a 35-h.p. General Electric motor. A 10-h.p. Holliday gasolene engine is provided as an auxiliary. The piers are concrete on a piling foundation. The track between piers 1 and 2 is carried on an earth fill retained by a creosoted sheet piling bulkhead.

The bridge was designed and built by the Missouri Valley Bridge & Iron Company, Leavenworth, Kan. We are indebted to Mr. A. L. Phillips, Assistant Chief Engineer of the New Orleans Terminal Company, for the illustrations.



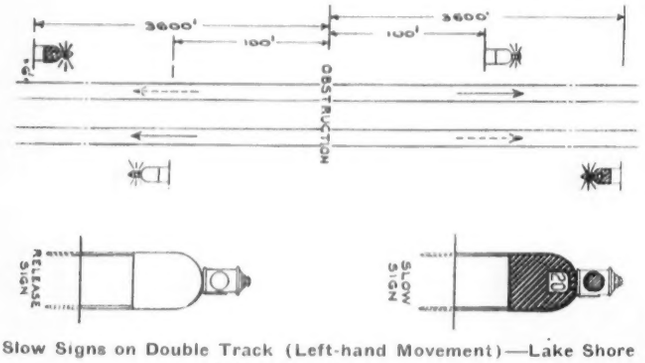
Details of Bascule Bridge over New Basin Canal—New Orleans Terminal Company.

Lake Shore Signal Rules.

Mr. Azel Ames, Jr., Signal Engineer of the Lake Shore & Michigan Southern, has issued a new book of rules governing the use of interlocking, block and train order signals, and the rules are to go into effect on the first of August. The book opens with a "general notice" and "general rules," like the Standard Code of Train Rules. Following the definitions and "principles of location," come the interlocking rules numbered 301 to 388. Nos. 321 to 338 are for enginemen and trainmen, and 341 to 388 for signal men. One of the "principles of location" is that the upper arm governs the main or superior route; the lower arm inferior diverging routes, and the "middle arm" (if any) any important branch or connection. Interlocking semaphores have a movement of 60 deg.

Enginemen must know the indication of all fixed signals before passing them—which must be a rather difficult thing to accomplish with distant signals when running at high speed in a fog. At railroad crossings, drawbridges, junctions and train order offices enginemen will "require" the fireman to observe and communicate the indication of all signals. Where fixed signals are in use trainmen must not give clear hand signals as against the indications of the fixed signals. Signal men report to and receive instructions from the division superintendent or chief despatcher; but to the signal engineer regarding the care and handling of the apparatus. Signals must be restored to normal "as soon as" the train or engine has passed them. Interlocking stations which have not a separate train order or block signal must have green flags and lanterns ready for immediate use.

Block Signals.—Under this head the principles governing location are, in so far as they apply, those governing the location of



Slow Signs on Double Track (Left-hand Movement)—Lake Shore & Michigan Southern.

interlocking signals. The rules are numbered 411 to 480 for telegraph block and 501 to 551 for automatic. Block signals may be used as train order signals, and interlocking signals may be used as block or train order signals. The principal telegraph block-signal rule is given in two forms; one allowing permissive blocking and the other not. The time-tables specify which of these rules is to be used at any given place. Where a despatcher authorizes permissive blocking on an absolute block section, he will direct the signal man to issue a caution card and will specify a number to be entered on the card. Automatic signals are classed as permissive signals and automatic semaphore arms have a pointed end. When such a signal indicates stop the train or engine must be stopped, and, "after having stopped" may proceed with caution, etc.

Slow signs are described in a short chapter by themselves. The slow sign is a low signal of banner type and a signal of similar shape is fixed at the point where trains may resume full speed. The slow sign is painted green on its face and has a numbered plate indicating the speed, in miles per hour, at which trains may run. The sign indicates that the track 3,600 ft. distant is unsafe for high speed. Release signs are painted white. The arrangement of slow signs on double-track (left-hand movement) is shown in the accompanying drawing. In the book the drawing is suitably colored. There are also about 20 pages of colored illustrations of high and low semaphores, pot signals, etc. The night stop indication in dwarf signals is a purple light.

Slow Freight Rates in India.

BY WILLIAM A. DRING,
General Traffic Manager, East Indian Railway.

Treating generally of the railroads in India, they are the property of the State, and are worked either directly by the State or by companies constituted for that purpose, and administering the lines under contract with the Secretary of State for India, who retains large powers of control. These companies receive remuneration for their services by means of a division of the net profits after payment of the working expenses, and the interest charges on the capital expenditure, the Government reserving to itself the lion's share. Thus in the case of the most prosperous railroad worked by a company, out of net or surplus profits for a year amounting to £1,400,000 sterling, the State received £1,260,000 and the company the balance of £140,000.

The following particulars for the railroads in India during the year 1903 are given in the form adopted by Mr. Harry Smart, Secretary of the Railway Clearing House, in his International Railway Congress paper on slow freight rates in the United Kingdom. The year taken is 1903, the figures for 1904 not being complete:

(a)	Length of railroads worked	26,955 miles.
(b)	Receipts per mile	£891
(c)	Cost per mile of maintenance of way, works, etc.	£100
(d)	Expenditure of all kinds, per mile	£424
(e)	Proportion per cent. of expenses to receipts	47.5

The receipts from coaching traffic are about one-third of the whole, and from merchandise and mineral traffic, taken together, about two-thirds. The total weight carried of merchandise and coal, including stores for consumption on the several railroads, was 47,684,000 tons, and the average distance per consignment carried, or the average lead of the traffic as a whole, was 160 miles.

It should be stated that in the year 1904 there was a great advance in the prosperity of Indian railroads, and it is estimated that when the detailed figures of working are published, they will show in gross receipts an advance over 1903 of not less than 10 per cent., with a reduction in the proportion per cent. of expenses to receipts. This prosperity has enabled the State to develop its program for the enlargement of the railroad system in India, and the improved equipment of existing lines.

The greatest average annual construction of railroads in India was during the first Viceroyalty of His Excellency Lord Curzon, from 1899 to 1903, when the average actual mileage opened per year was as nearly as possible 1,000 miles. During the last year of the series it was arranged to construct over 1,250 miles.

GOVERNMENTAL CONTROL OVER RATES.

The initial control exercised by the Government of India over rates for the carriage of merchandise and coal is by means of a scale laying down the maximum and the minimum rates which may be charged for the various commodities. The scale may be summarized as follows, it being premised that one pie equals one-twelfth of a penny, and a maund one-twenty-eighth of a ton of 2,240 lbs.

	Pie pr md., pr mile. Maximum.	Minimum.
Coal, wheat, other grain, oil seeds, jute, salt & other articles of low value from.	1/3	1/10
Ordinary commodities ..... Between	1/3 and 1	1/6

There are powers allowing special treatment of articles of exceptional bulk in regard to weight, such as loose cotton, heavy articles, such as boilers, and articles of exceptional value, such as specie or bullion.

The highest charge allowed is, therefore, twenty-eight-twelfths, or 2⅓ pennies per ton-mile of 2,240 lbs., and the lowest, 1/10 of this amount, or .233 of a penny, somewhat less than one farthing per ton-mile. The average actual charge made in 1903 on the total merchandise and coal traffic of all Indian railroads, taken together, was .47 penny per mile per ton of 2,240 lbs., or .41 penny per mile per ton of 2,000 lbs.

Confined within the maximum and minimum charges, there are separate standard classifications for ordinary merchandise and for coal. In regard to the great majority of ordinary items of merchandise, there is uniformity of classification on the different railroad systems, but for raw agricultural products, salt, iron, gunny, kerosene oil, etc., forming the bulk of the ordinary merchandise traffic, each principal system has its own scale.

The standard classification for ordinary merchandise has remained unaltered for a number of years, the requirements arising from time to time for reduction in charges having been met by the quotation of special, or station-to-station, rates, always within the limits laid down by the Government of India. The scale of charge to the consignor is in this way being constantly reduced.

For ordinary commodities there is no differential treatment or lowering of rates as the mileage is increased. With agricultural produce and other articles of low value this treatment is adopted. The following standard classification in force on the East Indian Railway, which carries a heavier traffic than any other line in India, may be taken as to "Special" class (principally agricultural produce) goods as applying approximately throughout the trunk lines of India, and as to ordinary commodities, as actually so applying:

Special Class.

	Pie per md. per mile.
For first hundred miles	.3333
For extra distances, about 100 up to 450	.17
For extra distances above 450 miles	.12

Ordinary Commodities.

	Rate—pie per md., per mile.
First class	1/3 " " "
Second class	1/2 " " "
Third class	2/3 " " "
Fourth class	5/6 " " "
Fifth class	1 " " "

The comodities included in higher classes than the second, which pays as nearly as possible 1 penny per ton-mile of 2,000 lbs., form a

very small proportion of the whole traffic. The rates given in the ordinary commodity schedule are the highest allowed by the Government control, for each class. The reductions below the respective scales, within the Government minimum of ⅛ pie per md. per mile, are, generally speaking, by means of station-to-station quotations.

Terminals may be added varying between, say, seven pence and half a crown per ton, the average probably being between one shilling and one shilling and sixpence. These terminals are, however, frequently reunited, especially in the case of traffic carried over considerable distances. For the terminal charge made, loading and unloading are performed by the railroad; but there is no cartage or other delivery off the premises, except in a few isolated cases, consignors and consignees being left to perform these services themselves.

In addition to the control exercised by Government by means of maximum and minimum rates, the power is retained of ordering specific quotations if considered to be required, though such power has not in the experience of the writer been ever used, and alterations in rates are scrutinized by Government officers at the headquarters of the several lines. Every change in charge must be included in a statement submitted monthly for scrutiny; and permission must be obtained from the local Government controlling officer before transfer of an item from one classification to another. Every authorized charge is included in a printed rate book, and invoices are checked by the accounts department. An invoiced rate not given in the rate book is objected to, and for each alteration in the rate book or tariff, authority must be shown. At the present time there is indication of a relaxation of the control exercised in the matter of rates; but it seems probable that the working companies when proposing changes of great importance will, even though they may be acting within their powers as governed by the standard of maximum and minimum rates, ascertain, before introducing the changes, the views of the Government as the predominant partner in the undertakings placed in the companies' charge.

Railroads in India, as regards liability, are not common carriers, but are bailees for hire. They are required to take the same amount of care of goods entrusted to them for carriage as a man of ordinary prudence would take of his own property. They are further allowed to relieve themselves of this liability by the quotation of reduced rates at owner's risk, and if these reduced rates are accepted by the consignor the railroad is freed from all responsibility from whatever cause, even though that cause may be the proved neglect or dishonesty of the servants of the railroad. There has been some comment on the extent to which freedom from liability is carried. Certain articles of special value, such as those of which gold or silver forms part, and Cashmere shawls, are "excepted"; that is, the railroad incurs no liability for their loss or damage.

REDUCED RATES FOR WAGON LOADS.

In India special attention is paid to the securing of good wagon loads. The carrying capacity of wagons is higher than on English lines, the standard gross load of four-wheeled wagons built during the last ten years being for the broad gage (5 ft. 6 in.), 24 tons, of which the net load is 16 or 17 tons. Certain railroads are now increasing the load of four-wheeled wagons to 28 tons, of which the net load is 20 tons. In order to make full use of the individual wagon capacity, the practice is growing of offering reduced rates for consignments of weights suited to the wagon capacity. The Calcutta export trade in wheat and seeds was till a year ago carried in multiples of 25 tons, each consignment taking two wagons; but the offer of a reduced rate by about 6 per cent. for 30-tons lots has been quite successful, and at the present time the two wagons which formerly carried 25 tons are taking 30 tons, and the reduction of 6 per cent. in charge has brought an increase of 20 per cent. on the wagon load. For 1903 the average load of a loaded goods vehicle, on the principal railroads, varied between 7 tons and 9 tons, excluding mineral traffic of which the average load is considerably greater. Taking into consideration empty running, the average load varied between 5 tons and 6½ tons.

With the same object of inducing full use of the wagon capacity, charges are quoted per wagon load of a particular commodity, the consignor gaining an advantage as compared with maund rates if he puts in a good load. This principle has not so far been applied to wagons with mixed loads of different commodities, where a middle-man steps in and shares with the consignor the advantage of reduced freight charges.

Group rates for the principal commodities are coming into favor in India. Although there are exceptions of great importance, there is general acceptance of the "differential rate," under which, on the same length of line, the charge for the lesser distance shall not exceed that for the greater.

COAL.

The charges for the carriage of coal have received special attention, and during the last 15 years there have been two reductions in the scale of rates, of great importance. Before the first reduction, British coal was imported into Calcutta in considerable quantities, although coal of good quality was being raised at collieries having direct railroad communication, situated within 130 miles of Calcutta, while all other ports were supplied exclusively with British or foreign coal. The export of coal from Calcutta was unknown. At the present time practically all the coal consumed in India is mined in India, and large exports are made to Colombo, Singapore, and other external ports. Excluding bunker coal, there were shipped from Calcutta in 1904 over 2,000,000 tons of coal.

The principal collieries are situated on the line of rail at an average distance of about 150 miles from Calcutta. These collieries, in addition to sending to the port, consign coal over long distances to the interior, at present principally for railroad consumption. Probably more than a quarter million of tons are sent over distances exceeding 1,000 miles.

The collieries so far opened out in India, other than those near to Calcutta, are not of very great importance, the raising for 1903 having been about 1,000,000 tons only.

The first of the two reductions referred to in the opening portion of this paper having proved most successful in establishing an altogether new trade, the second reduction to the present scale was decided upon with the view of affording an impetus to the export trade, and also to assist coal in replacing wood and other descriptions of fuel at long distances in the interior. The scale is here given:

	Per md., per mile.
For all distances up to 75 miles, inclusive....	0.14 pie.
Plus for any distance in excess of:	
75 miles, and up to 200 miles, inclusive..	0.12 "
200 miles, and up to 450 miles, inclusive.	0.1 "
450 miles, and up to 1,000 miles, inclusive	0.09 "

The total charge being subject to the minimum fixed by Government of 1/10 pie per md. per mile, or something under one farthing per ton-mile of 2,240 lbs. The scale shows that even during the first miles of its carriage, coal is charged at less than one-third of a penny per ton-mile of 2,240 lbs., while for every mile over 450 the charge is reduced as low as one-fifth of a penny per ton-mile.

In order to assist the export of coal, a rebate of 20 per cent. is given off tariff rates. The value of coal as exported from Calcutta may be taken at 9s. 6d. per ton of 2,240 lbs., f. o. b.; that is to say, including cost of coal, carriage over 150 miles by rail and shipment charges. Coal is charged at owner's risk, and is loaded and unloaded by sender and consignee. The charges which have been given apply generally throughout the principal colliery districts.

So far as concerns coal, Indian railroads have a clear and concise tariff, without complications. There are no special station-to-station rates, and everything is according to the one scale, except where, under agreement, the longer route between the same points has equalized with the shorter, the charges in these cases being calculated by the scale on the shorter route. This simplicity is rendered possible by the circumstance that there is only one principal source of supply, and, therefore, no competition between different sources of supply competing for the trade of the markets of consumption.

SPECIAL QUOTATIONS.

For raw agricultural products there are probably not more special quotations than the importance of the traffic warrants. Here there are both competing sources of supply and competing marts of distribution.

For ordinary and unimportant articles, however, a mass of station-to-station rates and exceptional conditions has sprung up for the reason that there has been no general revision of classification, but individual treatment of each of some thousands of commodities. On pages 37 and 38 of the paper by Mr. Mange, Assistant Traffic Manager, Orleans Railway, it is shown that a similar growth of special quotations on the Paris, Lyons, Mediterranean Railroad has been met by reductions in scale, and abolition of the bulk of the station-to-station rates. The reduction of the scale necessarily could not be to the level of the lowest special quotation, and we are told that while those who profited by the general reduction kept silent, the sufferers by the increases protested energetically, so that although the reform was a considerable step in advance, it appeared to give rise to nothing but discontent.

There was the difficulty in making the alterations in the tariff of the French line, that commodities of the first importance came under revision; but, as it has been endeavored to show in this note, on Indian lines the scale for the charge of coal is simple, and agricultural products have not undue complications, though there are probably a number of station-to-station rates which, at one time necessary, have served their purpose and could be withdrawn. Of the five ordinary classes, it is probable that a readjustment in scale could be arrived at for the three higher classes, which, without having any seriously detrimental effect on revenue, would enable the great bulk of the station-to-station rates to be withdrawn without causing discontent to consignors. The same remarks apply in a less degree to the two lower classes of ordinary goods. Here larger interests are concerned, both for the consignor and for the railroad. Profiting by the experience of the French line, important station-to-station rates would be preserved; but with a small reduction in scale a large number of special quotations would disappear. The subject of sim-

plification of goods tariff is now having the attention of the Indian Railway Conference Association.

POSSIBLE DEVELOPMENTS.

The question of slow freight rates for Indian railroads is at present in an interesting position. While, as already shown in this note, the powers given to the managements of the various lines by the Government which owns the lines permit a maximum charge on high class goods of 2⅛ pennies per ton-mile, and on coal and low-class goods a maximum of one-third of this amount, or .77 penny per ton-mile; and forbid a lower charge than .38 penny for high-class goods, and than .23 penny for coal and low-class goods, the *average* charge in 1903 on all Indian railroads taken together, was for all merchandise, including coal, under .5 penny per ton-mile, and for coal taken by itself .26 penny per ton-mile. The average charge made is thus out of all proportion nearer to the minimum than to the maximum allowed, the result being brought about by the low rates levied on coal carried for export or over long distances to the interior, and on grain and seeds carried to the ports of Calcutta, Bombay and Kurrachee. Many of these rates are actually down to the minimum allowed of .23 penny per ton-mile.

Until the commencement of the present decade, the Government of India as a proprietor and guarantor of railroads was losing large sums of money annually on the working of the lines as a whole, but for four years in succession there has been a surplus, and there has been such steady progress that it may be hoped that for the future the position will constantly be of income greater than expenditure. It is, however, by no means the case that all roads earn sufficient to cover their working expenses and the interest on capital outlay. The statistics, indeed, show that of a total mileage of, say, 27,000, only about 10,000 miles are being worked at any profit, and only about 5,000 miles at any considerable profit. Carrying the examination a step further, it is seen that the system of about 2,250 miles from which the largest share out of all proportion of the profits comes, is that which charges the lowest rates, this system being specially favored in the matter of gradients, coal and a steady traffic, so that the cost per ton-mile carried is much lower than on other Indian lines.

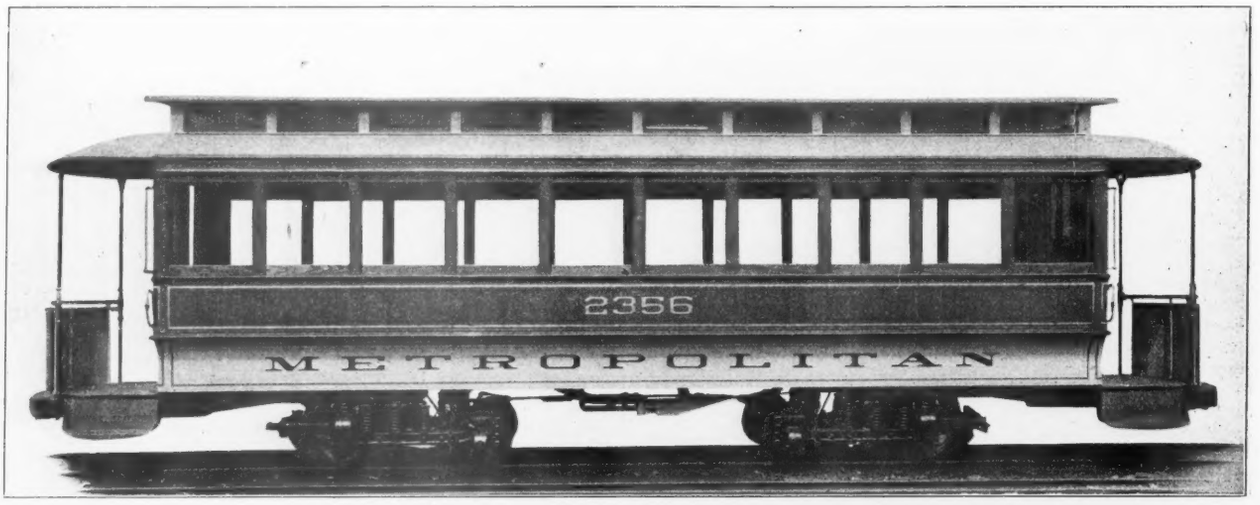
COST PER TON-MILE.

In India there are accurate statistics of ton miles, and a rough and ready method has been adopted of apportioning the cost of working between coaching and goods traffic. This method is open to just criticism, but for the purpose of comparison between different lines may be accepted without fear of great error, the proportion of goods and coaching traffic to the whole on important railrads not being dissimilar. There are three principal ports to be served—Calcutta, Bombay and Kurrachee. Working on an average for five years, and assuming the cost of carriage to Calcutta as 1 per ton-mile, the cost to Bombay is 1.81 and to Kurrachee 1.80.

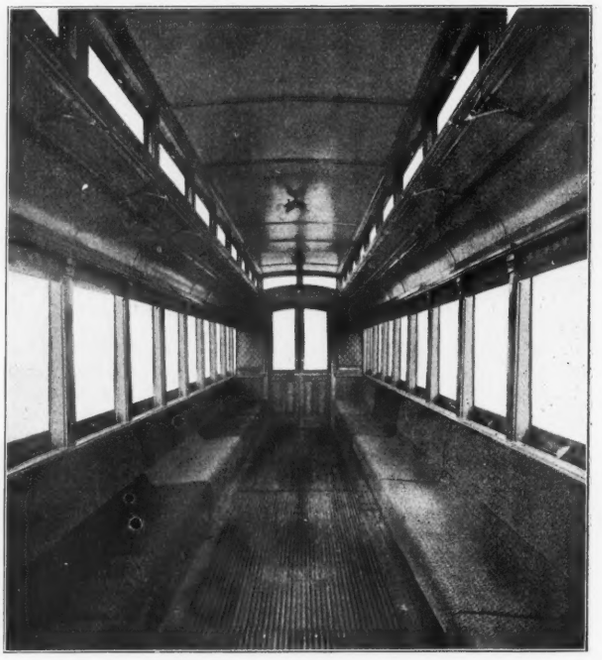
The present minimum charge of .23 penny per ton-mile is acting as a restraint on the operations of the managements to which Government has entrusted the working of its railroads, and it seems probable that in the early future the Government may consider whether the minimum can be reduced. There will then be the problem whether, as hitherto, there shall be one minimum for all alike, or whether the cheap working line shall be allowed to charge a lower rate than the system where the prevailing conditions do not permit of the same economy. In other words, whether the cost of working shall be taken into consideration in fixing the minimum rate which may be quoted by the different systems. It is too much to expect that there shall be a different minimum for each railroad, small and large; but it is submitted that different minimum rates based on cost of working could be laid down for the larger systems, and a general minimum for the smaller, and that such a procedure would be both fair to the consignor whose goods are to be carried, and in the interests of Government as owning the railroads.

Steel Car for New York City Railway.

For some time past there has been a growing tendency on the part of railroad officials to consider the use of steel in the construction of passenger cars on the ground that it increased safety for the occupants and offered a possible decrease of weight, and because such a construction was in accord with modern advancement. Until recently, however, comparatively little has been done in the way of a practical application. Steel has crept into passenger car construction to a limited extent in details, such as body bolsters, carlines, trusses and the like, but it was not until the subway cars were built that an all-steel construction was used to any extent, though cars had been designed and built with steel framing a number of years ago.



Steel Street Car for the New York City Railway.

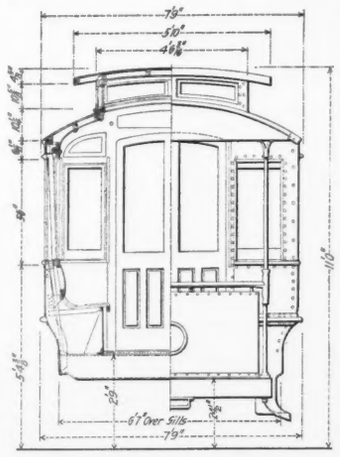


Interior of Steel Street Car.

Following closely on the construction of the all-steel cars for the New York subway, and those with pressed steel underframing for the Brooklyn Rapid Transit, a car has been built by the Pressed Steel Car Co. for the New York City Railway and placed in service on the Broadway run, that is built of steel throughout. A controlling reason for the construction of the car was to obtain one that would

avoid all danger of fire through accidental short circuiting or other causes.

In the car under consideration, no wood has been used at all except for a portion of the window sash, the linings of the window posts, the roof, ceiling and floor matting strips, and these have been thoroughly treated with a fireproofing compound. In general appearance the car bears a close resemblance to the wooden cars of the same class, and this has been sought throughout the design; the bottom heads of the rivets on the paneling and window posts alone serving to indicate the fact that the car is built of steel.

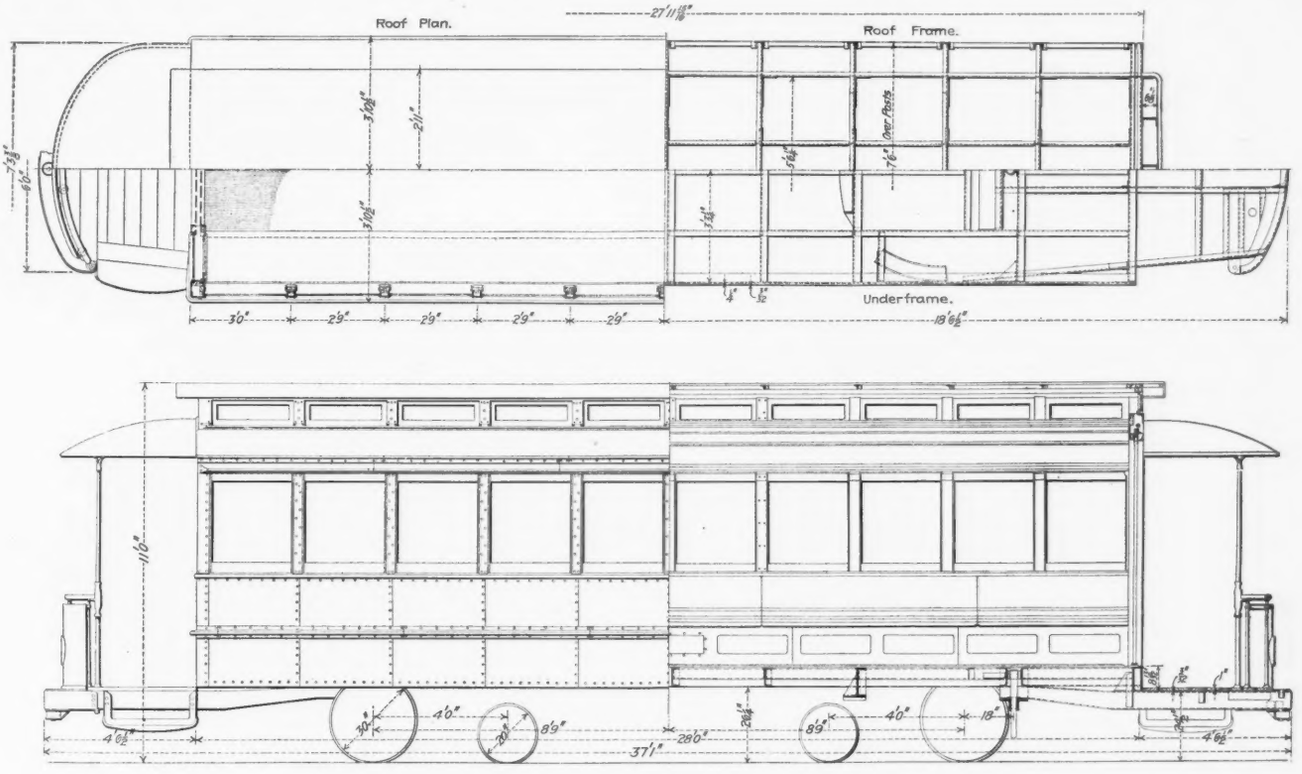


Part End Elevation and Cross-Section of Steel Street Car.

The body is 28 ft. long and the over-all dimension is 37 ft. 1 in. to the outside of the platform and sill. Complete with the trucks the car weighs about the same as a wooden car of the same type. As with other designs coming from the Pressed Steel Car Co., pressed steel is extensively used throughout the frame, and this applies not only to the underframing but the superstructure as well. The side and end sills are of pressed channel shapes, and the former are tied together at intervals by cross-tie beams extending from side to side and formed with closed ends that are riveted to the side sills. The intermediate sills are built up of pressed channel sections that are riveted to the cross beams, as shown on the plan.

As the car is carried by the Brill maximum traction side bearing trucks, wherein the whole load rests upon the side bearings, no body bolsters are required, but a stiffening cross-brace is use above the ends of the side bearing castings. The general arrangement of the framing of the platform bears a close resemblance to that of the ordinary wooden car. The belt rail is also of pressed steel, whose section will be readily understood by a reference to the side elevations of the car. The paneling is formed of steel plates extending from the bottom of the side sill to the belt rail, where there is a division, the panels between the belt and the window rail being separated from those below. By making the panels and belt rail in sections in this way, provision has been made for repairing any portion of the side that may be damaged without disturbing the uninjured portion of the car; thus materially reducing the expense of repairs. The ceilings and interior finish is of fireproofed composite board, so that the general appearance of the standard car has been maintained.

The total width of the car over the belt rail is 7 ft. 9 in. and the height of the monitor roof above the rail is 11 ft. The other general dimensions will be found upon the line engravings of the elevations and plan, while the reproductions of the photographs give a clear idea of the outside and interior appearance.



Plan and Side Elevation of Pressed Steel Street Car for New York City Railway.

A Study of the Walschaert Valve Motion.*

BY W. PFITZNER.

The object of the following study was to enable a valve motion to be designed on paper to a convenient scale and with sufficient certainty to render it unnecessary to test the design on a model. The best method of procedure is to investigate the influence of each member by means of an adjustable model. The model used for the purpose was made half size, in accordance with the scheme shown in Fig. 1. The dimensions given are in millimeters. The design was made up from a Muller valve diagram, the size of the resultant eccentric being determined from the assumed curve for 80 per cent. cut-off.

The important phase points in the steam distribution were determined by means of valve ellipses drawn directly by the model. The valve stem carried a pencil while the paper was carried on a table moved at right angles to the valve by a reducing motion from the crosshead. By laying down the port dimensions on the ellipses thus drawn, all the points of steam admission and exhaust were clearly marked for both sides of the piston. A similar recording device connected to the link and the block gave a record of the slip of the block, in order to determine the effect of the suspension of the radius rod on the slip.

The information as to the steam distribution obtained from the valve ellipses is recorded in the so-called curves of errors, which give a direct criticism of any design of gear. These curves of errors show the differences between the steam distribution at the head end and that at the crank end. The cut-off in the crank end is taken as an abscissa, and the ordinates give the amounts which must be added to the admission, exhaust, etc., to get the corresponding value for the head end with the same valve setting. Conse-

*Translated by Lawford H. Fry from the *Zeitschrift des Verein Deutscher Ingenieure*, March 25, 1905.

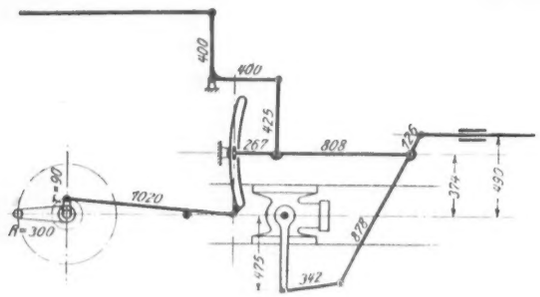


Fig. 1.

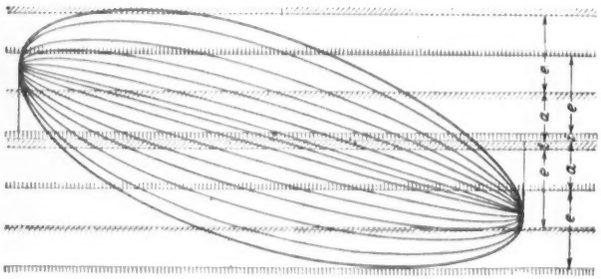


Fig. 2.

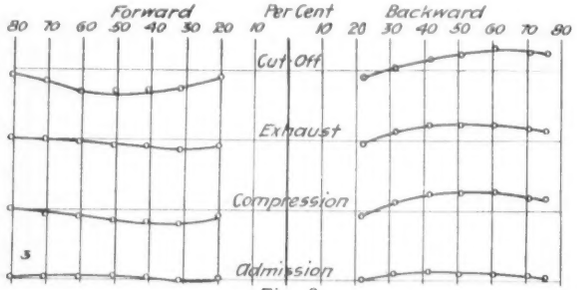


Fig. 3.

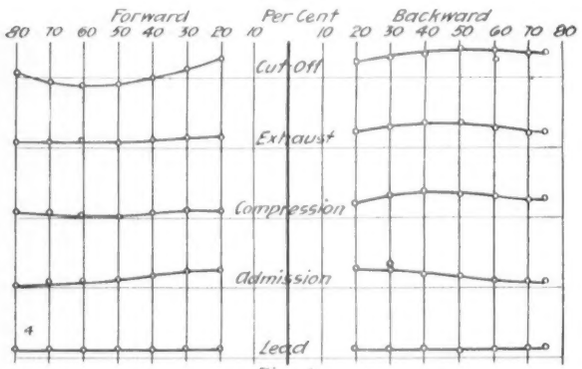
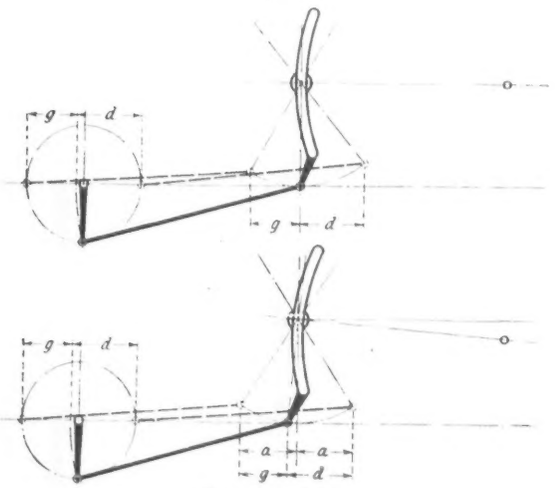


Fig. 4.



Figs. 5 and 6.

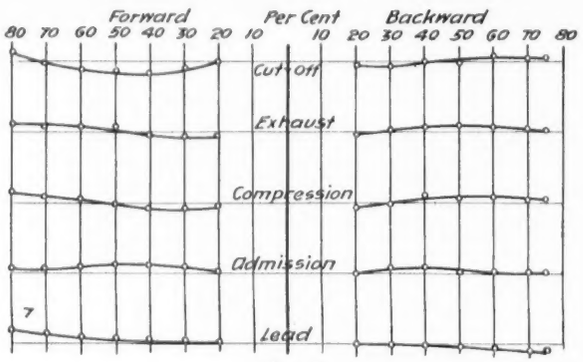


Fig. 7.

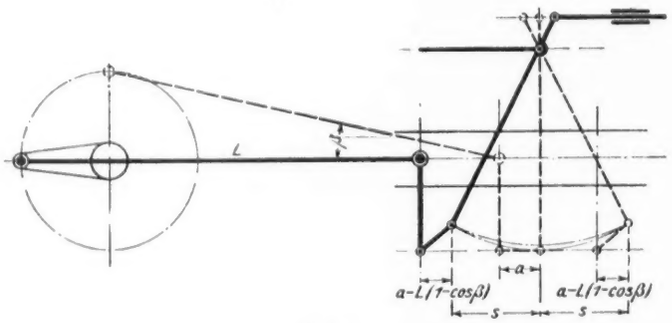


Fig. 8.

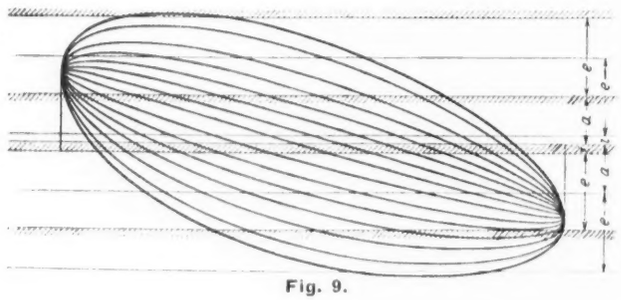


Fig. 9.

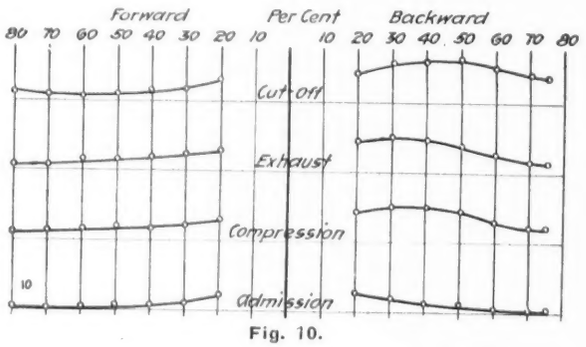


Fig. 10.

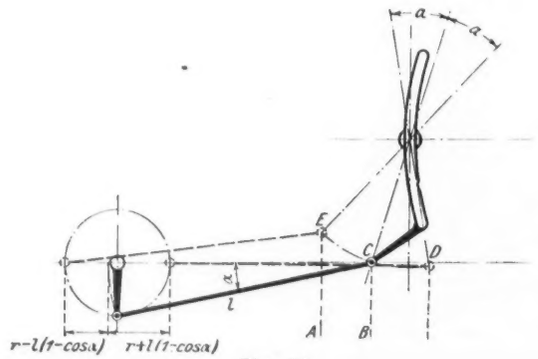


Fig. 11.

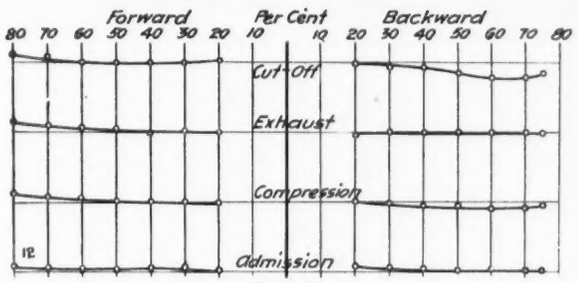


Fig. 12.

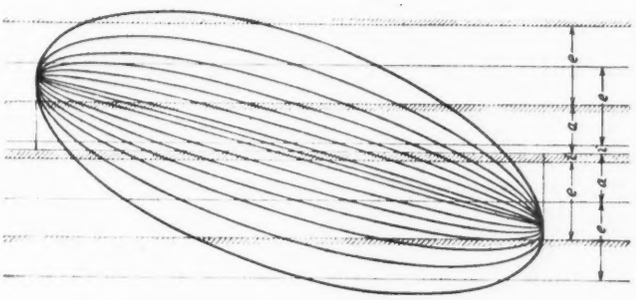


Fig. 13.

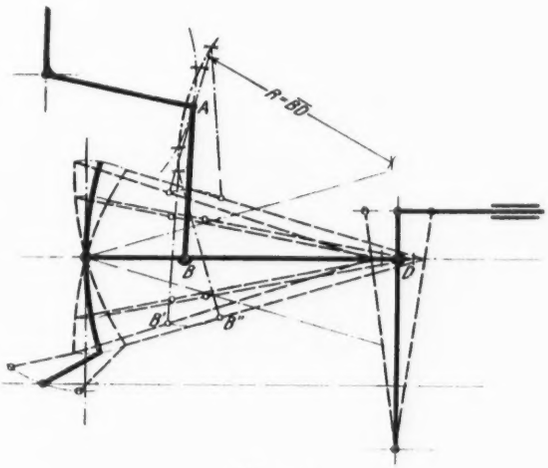


Fig. 14.

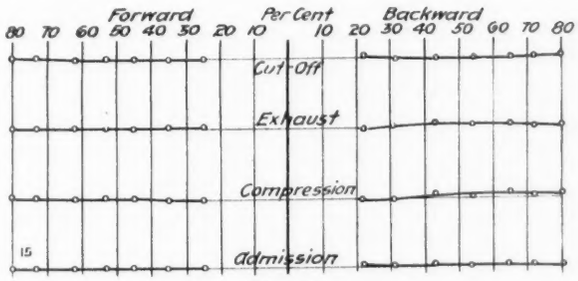


Fig. 15.

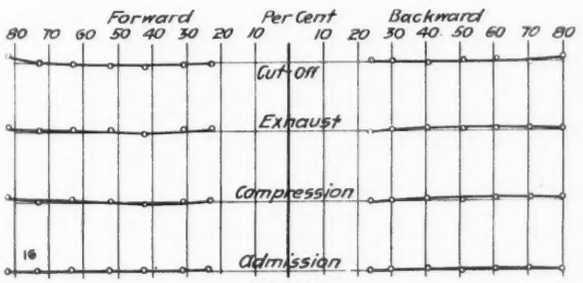


Fig. 16.

quently an ideal valve motion will give a series of straight lines on the horizontal axis.

Test Series A.

The valve motion was as shown in Fig. 1. The valve ellipses, which are shown in Fig. 2, are not irregular when compared with those from other valve motions, but they show some considerable variations in the steam distribution. From the curves of errors in Fig. 3 it will be seen that the cut-off was only the same on both sides when running backwards at a cut-off of 29 per cent. The greatest difference between the two sides is nearly 7 per cent., and the other points in the distribution show similar variations.

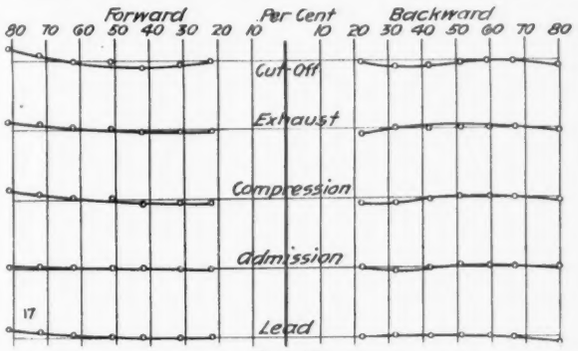


Fig. 17.

When running forward the cut-off on the head end is always too early and it might therefore be thought advisable to shift the position of the valve so as to change the position of the ellipses in relation to the port openings and thus increase the time of admission on the head end. This can only be done at the expense of the previously constant lead.

Test Series B.

In order to increase the admission at the head end it is necessary to move the valve towards the crank and the valve stem must be shortened. The lead is changed by double the amount of the shortening which in the tests amounted to about $^{3}/_{16}$ in. The curves in Fig. 4 show the results of the change. The forward motion

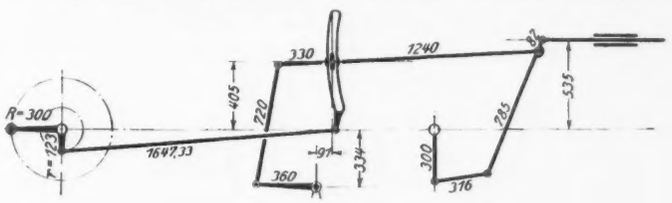


Fig. 18.

shows the desired improvement in equalizing the cut-offs which are the same at two points. In backward motion the results are worse than before, but undoubtedly the greatest defect is the considerable variation in the points of pre-admission. Figures 3 and 4 show what influence a wrongly placed valve will have on a motion otherwise correctly designed.

The desired improvement cannot be obtained in the way tried, and instead of changing the position, it is necessary to change the motion of the valve.

Test Series C.

By closely examining the valve curves it will be seen that one side is more strongly curved than the other, that is the valve does not travel equal distances each side of its center. This cannot be due to the motion transmitted from the crosshead, for it can be

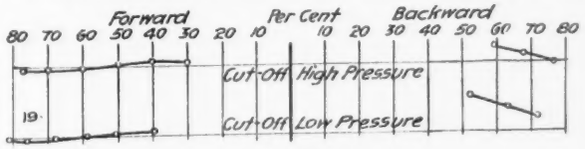


Fig. 19.

seen in Fig. 2, that with the block in mid-position the ellipse is contracted to an almost straight line and the lead is the same on both sides. The difference in the travel of the valve in the two directions is due to the angularity of the eccentric rod as shown in Fig. 5. It was therefore attempted to counteract this, as shown in Fig. 6, by shortening the eccentric rod so that the throw of the link is the same on both sides of its central position. With this arrangement when the main crank is at the dead points the link is moved from its central position by the amount L (1— cos ϕ), where L is the length of the eccentric rod and ϕ the angle this rod makes with the horizontal when the main crank is on the dead point. As a

consequence of this the lead changes as the duration of admission is increased.

The error curves, Fig. 7, show that the distribution is better than was obtained with other arrangements; the greatest variation only amounts to about 3.5 per cent. In backward motion the distribution is good, except that the considerable variation in the lead is a disadvantage.

Test Series D.

The attempt was made to influence favorably the form of the valve ellipses by changing the motion given to the valve by the cross-head. At the same time a procedure was tried which has been widely referred to. The effect of the angularity of the connecting rod on the motion of the valve can be counteracted by making the crosshead link so short that in the end positions its horizontal projection is shorter than the real length of the link by the amount $L\ (1-\cos\beta)$. This arrangement is shown in Fig. 8, from which it will be seen that the angle at which the link works is very unfavorable. The valve ellipses are shown in Fig. 9. At midgear a line is produced which has a slight downward curve, and on this the other curves are built up but with unequal travel in the two directions. Fig. 10 shows the variations in the steam distribution which are large, amounting in the backward motion to 13 per cent. Since the cut-off is always too late on the head end, the distribution could be improved by lengthening the valve rod, but this would give a changeable lead.

A shortening of the eccentric rod as in the Test Series C gives no important change in the error curves. This arrangement D shows itself to be undesirable in every way. The direct and accurate transmission of the cross-head motion to the valve is one of the most important advantages of the Walschaert valve motion, and any deviation from this only introduces errors. It is incorrect to attempt to counteract the angularity of the connecting rod in the valve motion. The cross-head link should be taken into account and made of sufficient length.

Test Series E.

An improvement in the steam distribution can only be achieved by overcoming the effect of the angularity of the eccentric rod. A simple means of doing this is to move the point C, Fig. 11, towards the crank. By trial a point can be found for C, such that the angles of vibration of the link each side of the center (C E, and C D) are nearly equal. The great improvement effected by this change is shown in the curves of errors in Fig. 12. In the forward motion there is scarcely anything more to be desired. The valve ellipses which are reproduced in Fig. 13 are almost mathematically correct. The variations in the distribution in the backward motion are due to the suspension of the transmission bar.

Test Series F.

In all the previous experiments the suspension of the transmission bar has been that shown in Fig. 1. The choice of dimensions was an arbitrary one. In order to improve the distribution the end A of the suspension link should be carried on a locus which is such as to lead to the expectation of good results. The construction for determining such a locus is shown in Fig. 14. The link block is considered to work without slip, and the end positions of the point B are determined for all degrees of cut-off. From these points with the radius B A, the length of the suspension link arcs of circles are drawn. The points of intersection lie on the dotted curve, which has its concave side towards the cylinder and coincides very closely with a circle having a radius B D. If the suspension link has its end A carried on this curve the valve will move very nearly correctly in all positions.

In practice* it would be difficult to find a place for the reverse shaft in the neighborhood of the cylinders and this arrangement cannot be used. The curves of errors have been drawn in Fig. 15 and show how close the distribution is to being the same at both ends of the cylinders. The variations are hardly noticeable.

Test Series G.

In practice, where it is necessary to have the reverse shaft in the neighborhood of the link, the point A must be carried on a circle having its concavity the reverse of that of the theoretical curve. To obtain good results the actual circle should be arranged so as to be in contact with the theoretical curve as much as possible, particularly at those points corresponding to the most usual points of cut-off. Such an arrangement is shown in Fig. 14. The curves of errors, Fig. 16, are nearly as smooth as those of Fig. 15. Usually the angle between the arms on the reverse shaft cannot be made a right angle.

Test Series H.

It is of interest to know how the steam distribution is influenced by the riding of the engine on the springs. The influence cannot be large because the motions taken from the machinery for the movement of the valve are all at right angles to the motion due to play on the springs. In the model the axle was raised about three-quarters of an inch, corresponding to a movement of 1½ in. on the real engine. The results are shown in Fig. 17, which is otherwise from the same motion as Fig. 16. The variations are very slight, amounting to about 1.5 per cent. at medium cut-offs. The lead shows a slight change.

The Slip of the Block.

The slip of the block in the link was measured by the apparatus described above. The slip is reduced in proportion as the suspension link is correctly carried. In the tests recorded the suspensions used in Test Series A to E give slips up to about 1⅜ in. actual. In Test Series F the slip up to 80 per cent. cut-off was only ⅛ in.; in the back motion the slip was ⅝ in. at 60 per cent. cut-off and 1⅛ in. at 80 per cent. In test series G, which would represent the actual construction, the slip was about ⅛ in. at 60 per cent. cut-off in the forward motion, and about 1 in. at 80 per cent. In the backwards motion the slip ran from ⅝ in. to 1⅛ in. It may be concluded from the foregoing that the slip may be held down to a very small amount if the suspension link is carried approximately in the proper locus.

For purposes of comparison Figs. 18 and 19 are given to show the outline, and the curves of error of the cut-off point, of the valve motion for the standard 4-4-0 compound locomotive of the Prussian State Railways. This motion is designed for the forward motion only and no attention is given to obtaining equal points of cut-off in the backward motion, and no attempt is made to counteract the angularity of the eccentric rod. The excellent steam distribution in the forward motion and the small slip of the block are obtained by slightly shifting the point about which the link turns.

The rules which should be observed in designing a new valve motion are few in number and may be summarized as follows:

The movement of the crosshead should be transmitted as exactly as possible to the valve; the crosshead link should be made long and where there is space it should swing about a central horizontal position.

The influence of the angularity of the eccentric rod should be overcome by moving the link joint towards the crank. The best position can be found by trial, as two or three points usually give the required solution. By this means very short eccentric rods can be used if necessary. The throw of the link is slightly increased.

In locating the top of the suspension link the locus method shown in Fig. 14 should be used.

*This applies with more force to European than to American locomotives. —Translator.

Railroad Shop Tools.

Continued.

PLANERS.

The accompanying illustrations, Figs. 1 and 2, show two planers made by the American Tool Works Company, Cincinnati, Ohio. The design of both machines is practically the same, the only difference being in the size. Fig. 1 shows a 24-in. x 24-in. planer, while Fig. 2 shows a 33-in. x 33-in. machine. The beds of these machines are of deep pattern and are made extra wide between the V's. They are strongly braced by box cross-girts at short intervals and are rigidly supported by short legs. The bed is made long in proportion to the table length and the tables have but little overhang when planing at full length. The central portion of the bed where the gears are mounted and where the strain is heaviest, is strongly reinforced. The V's are wide and are lubricated by oil rollers. The tables are fitted with T slots extending their entire length, and are also fitted with an improved dirt-proof device which protects the V's from dirt and chips. All T slots are cut and all holes are drilled and reamed

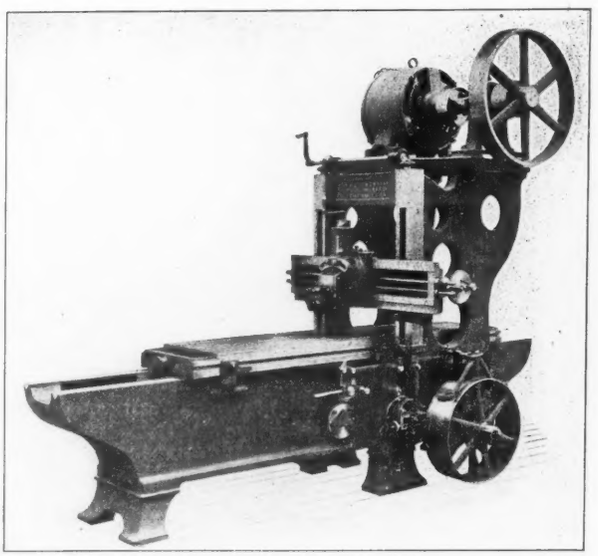


Fig. 1—American Tool Works 24-in.x24-in. Planer.

from the solid metal. The tables are provided with quick return and the reverse is practically void of all shock or jar. By an improved shifting mechanism the belts are moved from one pulley to the other before the return movement belt engages the other pulley; thus the slipping and shrieking of the belts is obviated. A safety locking device is also provided, which prevents the table from starting before the operator is ready. The back dogs are arranged so that the table can be run from under the tool for the examination of the work. The housings are of the double-webbed, cored section type and are securely held to the bed. The rail bearings are very wide and scraped to surface plates. The cross rails are of box section and are provided with wide bearings. They are raised and lowered by hand and are furnished with one head unless otherwise ordered. When two heads are ordered the 33-in. x 33-in. machine is furnished with an improved power elevating device, and the rail is made extra long so that one head can be made to plane the full width of the machine when desired. The heads are secured to the saddles by four bolts and have automatic cross, vertical and angular feeds. They can be operated from either side of the machine and the saddle is graduated for angular work, and down feeds are provided with micrometer adjustment. All driving shafts are of crucible steel and arranged so that they can be readily removed with all of their parts without disturbing the rest of the machine. The pinions are of steel and all gears and racks are cut from the solid. The bull-wheels are fixed on these shafts, which run in long bushed bearings. These machines can be furnished with any length of bed. The 24-in. x 24-in. machine when provided with a 6-ft. table has a bed 10 ft. long and the 33-in. x 33-in. machine when provided with an 8-ft. table has a bed 12 ft. 6 in. long. Two types of motor drive are shown in the accompanying illustrations. Fig. 1 shows an arrangement for motor drive, using the silent chain connection between the motor and the pulley shaft. The motor in this case is of the constant speed type and the ratio in the chain sprocket is varied according to the speed of the motor used, consequently any standard motor may be mounted as shown. This type of drive is also provided with gears substituted for the chain and sprockets. The drive pinion furnished is of rawhide to insure noiseless running and the housings are very rigid, and are cast in one piece with box section. This insures minimum vibration and maximum stiffness, which will easily withstand any strains sustained by reason of the motor attachment on top. The motor is substantially mounted upon a rigid bridge which connects with the housings and the arch, and

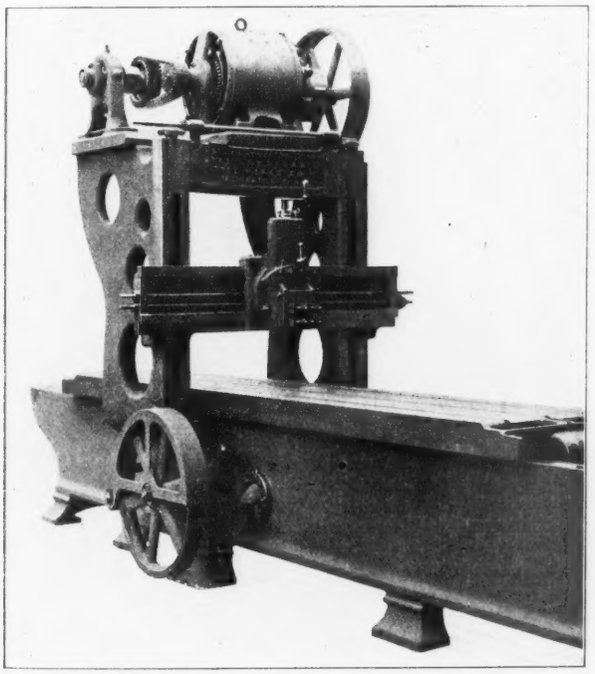


Fig. 2—American Tool Works 33-in.x33-in. Planer.

is securely bolted in place. The drive shaft is mounted upon massive stands which are adjustable for alining the motor and driving shaft. The stands contain ring oiled or dynamo bearings of very liberal proportions, which insure perfect lubrication and long life to the journals. The return drive pulley is furnished with a fly wheel rim in order to increase the momentum of the return pulley and belt, thus reducing the strain of reverse on the motor, and other parts. Fig. 2 shows a type of motor drive in which the motor shaft is connected direct to the upper driving pulley shaft by means of couplings as shown. This construction is used where the speed of the motor is the same as the required speed of the countershaft. The large driving pulley has a fly wheel rim and the housings and motor bridge are similar to those shown in Fig. 1. Both illustrations show arrangements as applied to planers having hand elevating device to rails with single head. When double head rails are supplied the power elevating device is furnished to all planers from 30 in. up, while all planers from 36 in. up are regularly furnished with a power elevating device whether single or double head.

Fig. 3 shows a locomotive connecting rod planer made by the John Bertram & Sons Company, Dundas, Ontario, Canada. This machine is of massive construction and has ample power for carrying four heavy cuts. Two heads are fitted to each cross-rail; thus two connecting rods can be planed at the same time. The machine admits 48 in. between the housings and 30 in. under the cross-rail, when it is at its extreme height. The standard length of bed is 16 ft. The saddles are arranged so that the tools on each cross head can be brought

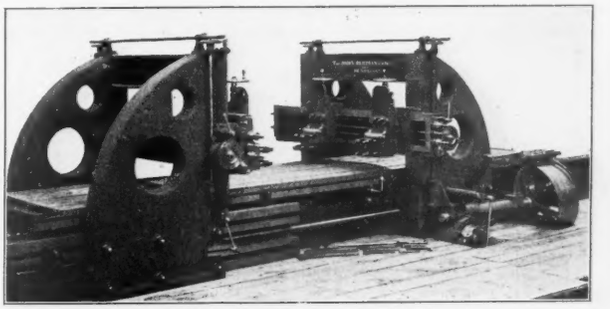


Fig. 3—The John Bertram & Son's Co. Connecting-Rod Planer.

to 10 in. from center to center. This machine is driven through spiral gears, and the movement of the table is parallel with the line shaft.

(To be continued.)

Railroad Employment Bureaus.

At the May meeting of the Association of Railway Claim Agents, Mr. R. C. Richards of the Chicago & North-Western, in discussing the question of railroad employment bureaus, said:

Having had constantly brought to my attention the expensive results caused by employing men who, by reason of their mental, moral or physical make-up, are not fitted for service in the operating department of a railroad, I have given the matter of how to remedy the trouble much consideration. I am satisfied that the only way is to give the matter the same attention and thought that is given the question of determining what class of engine or type of car, bridge, rail or structure is the best, as well as the most economical for a railroad company to adopt. These matters are given the most careful attention from the president on down through the ranks while the matter of inquiring into and passing upon the qualifications, character and record of applicants for employment who are to operate or care for these expensive engines, cars, bridges, signals, track, etc., with but few notable exceptions, is left to a clerk or a subordinate officer in the transportation or mechanical departments, when any inquiry at all is made. Any one who wears pants, who is under the age limit, or is willing to swear that he is, who by any possibility can pass the physical examination, who frequently is unfit for the business, dull of comprehension, hesitating and slow of speech, clumsy in movement and low in morals, is put to work solely because men are needed for immediate service, and there is not time to get the kind of men desired. The result is just what might be expected. Here are some examples of such a system of employing men:

(1) A recent inmate of an insane asylum, employed as a fireman of a stationary engine; no need of saying what happened.

(2) A city policeman recently discharged for rape is employed as a brakeman.

(3) A boy, more than half fool, is employed as a messenger in a switching yard on account of the importunities of his father who was an old employee; as a consequence the boy is injured.

(4) A morphine and cigarette fiend, known to be a monumental liar, is employed as a brakeman and turns up with a fake injury claim.

(5) A brakeman employed for 12 years is examined for the position of conductor and is reported to be so ignorant that, although an Irishman, he did not know the name of his national color.

On nearly all railroads civil service rules govern promotion and permanency of service, but the foundation on which the whole system should rest, the important problem of selecting applicants for employment and passing on their qualifications, seems to have been left out. Employing men for the operating department (and the same method would work advantageously in all departments) should be done by an officer or agent who is a good judge of human nature; one who would make it his business to look up young men

and there are thousands of them who are not only adapted to the railroad service, but who are anxious to get into it, but do not know how to go about it—pass upon the qualifications of the applicant, and if he appeared to be a desirable man, look up his record, and if satisfactory and he could and did pass the physical examination, put him on a waiting list, and when new men were needed supply them from that list.

Plenty of clean-cut, nervy, ambitious young men, coming from respectable families, of good standing legally, adjacent to the railroad, would at the present rate of wages paid by the railroad companies, jump at the chance of getting into the service, and by securing them the companies would not only get a higher class of men, morally, mentally and physically, than they do now, but would also in a measure secure the good will and interest of their families. This frequently in local and state affairs could be used advantageously and at the same time would prevent the employing of such characters as those above mentioned. We all know that it is the careless, unfit men, those who neither know the rules nor care to learn them, who have no adaptability for the service, that get injured themselves and cause accidents that result in injury to others and loss and damage to property.

How much better it would be to be able to telephone or telegraph the officer whose duty it was to employ and furnish men that you want so many agents, telegraph operators, firemen, brakemen, or switchmen, and know you would get good men, instead of being obliged to hustle around and hire the first thing you can pick up and call him an agent, operator, brakeman, fireman, or switchman, and then hold your breath fearing every minute a telegram will come calling for the wrecking car and the coroner or the chief of police!

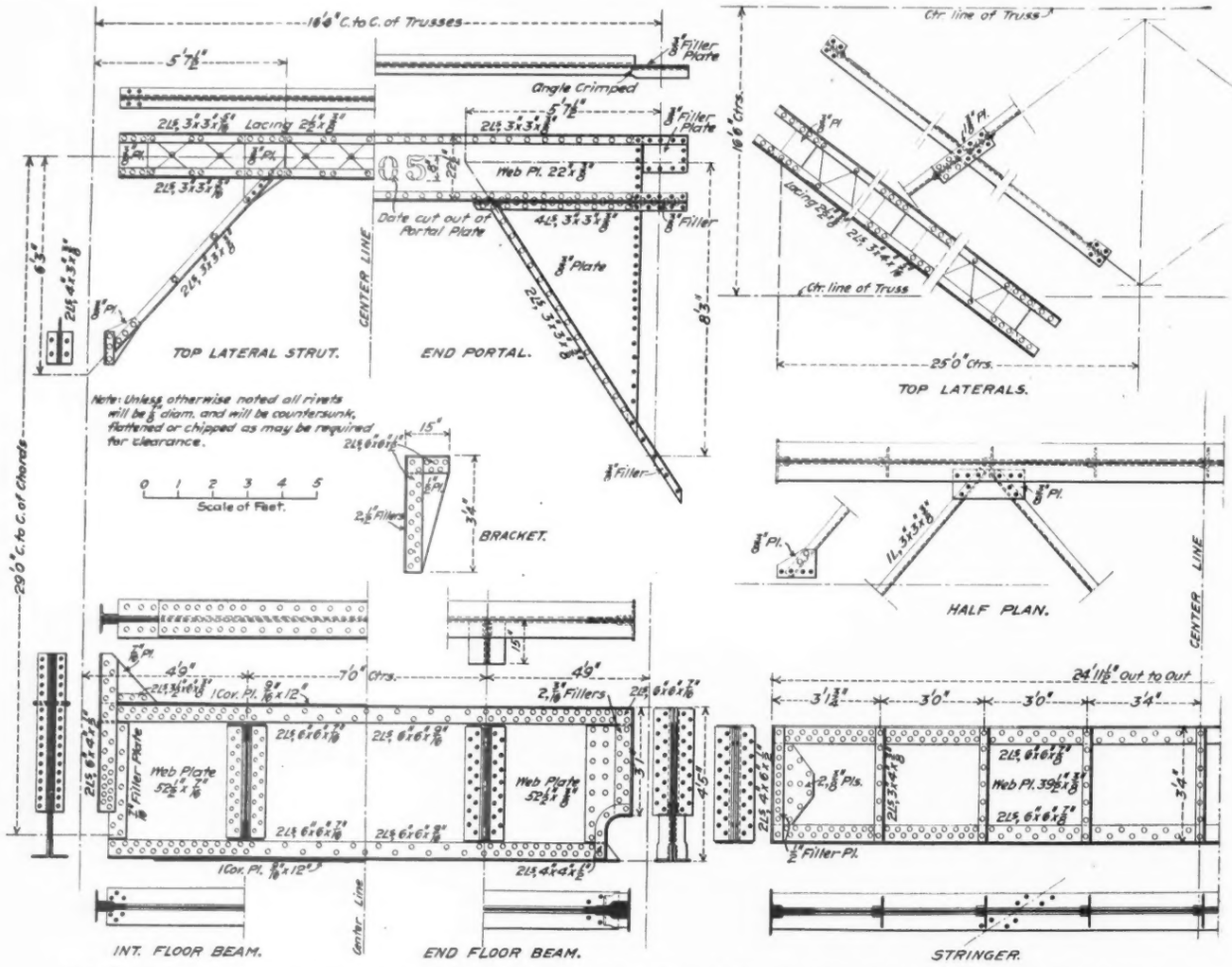
The adoption of such a plan would, of course, cost something and mean a lot of work for somebody to start and maintain it, but the cost would be nothing compared to the losses caused by the present method, and would, in the end, prove the best investment the railroad adopting it had ever made. It would demonstrate by results that it is as important to have good men as it is to have good engines, cars and roadway, and in a few years we would see a wonderful improvement in the class of men now engaged in the service.

If, in addition to having a Bureau of Employment, we also had a school in which to instruct the new men, and the old ones too, for that matter, what the rules and their duties are, and how to perform them, the labors of the claim department and the losses of the companies would be cut in half.

Standard Bridges on the Harriman Lines.*

The previous series of articles showed the standard designs of plate girder bridges for short spans from 30 ft. to 100 ft., and included the complete specifications for steel bridges. The accompanying drawings show the shortest of the riveted through truss bridges, which are used for spans from 100 to 150 ft., including 110, 125, and 140-ft. spans. They are designed for the same loading as the plate girder bridges and are to carry a single track.

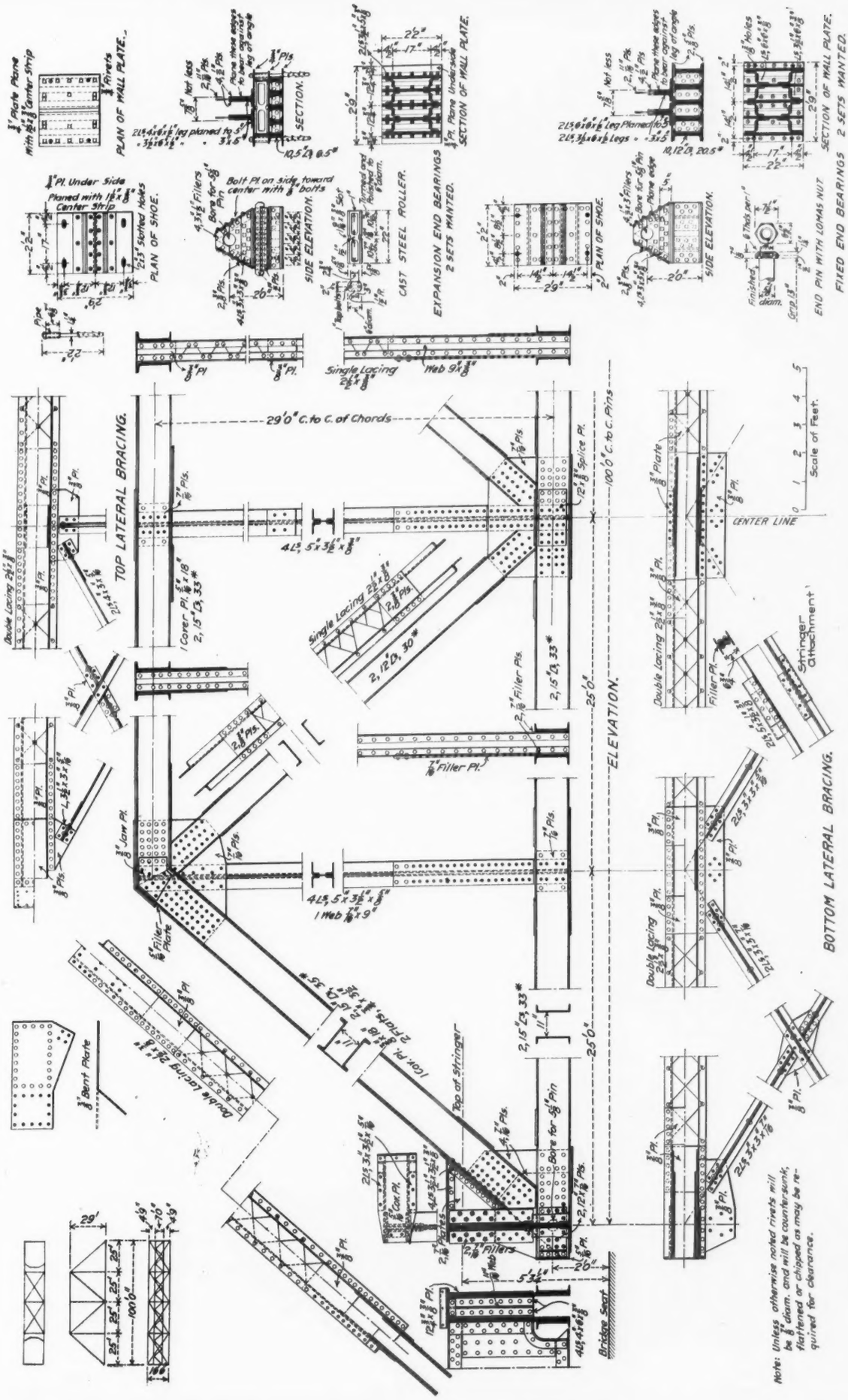
The panels are of uniform length, 25 ft., and the distance from center of bottom chord to center of top chord is 29 ft. The top and bottom chords are made up of 15-in. 33-lb. channels placed back to back, a 5-16-in. cover plate being used on the top chord and double latticing on the bottom chord. For the end diagonals a ⅜-in. x 18-in. cover plate, two 15-in. 35-lb. channels and two flats, ¾ in. x 3½ in. are used. The vertical members at the panel points are I-beam posts made up of four 5-in. x 3½-in. x ⅜-in. angles and a web plate 7-16 in. x 9 in., while the intermediate diagonals are two channels tied with single lacing. For the top lateral bracing double angles are used for the diagonals and laced struts for the transverse braces. Between the bottom chords diagonal angle braces only are used.



Details of Floor System and Portal Bracing for 100-ft. Riveted Through Truss—Common Standard, Harriman Lines.

The floor system consists of deep floor beams at each panel point riveted to the posts and a pair of stringers 40 in. deep between each floor beam. The ties are notched over the top flanges of the stringers in the usual way. At the ends of the bridge the end floor

*Previous articles appeared in the *Railroad Gazette*, Mar. 17, 24, 31, April 7, 14, 21 and 28.


PLAN OF WALL PLATE.
SECTION.
SECTION OF WALL PLATE.
EXPANSION END BEARINGS 2 SETS WANTED.
CAST STEEL ROLLER.
SIDE ELEVATION
PLAN OF SHOE.
END PIN WITH LOMAS NUT
FIXED END BEARINGS 2 SETS WANTED.
TOP LATERAL BRACING.
29'0" C. to C. of Chords
100'0" C. to C. Pins
ELEVATION.
CENTER LINE
Scale of Feet.
BOTTOM LATERAL BRACING.
Bent Plate
Bridge Seat
Note: Unless otherwise noted rivets will be 7/8 diam. and will be countersunk, flattened or chipped as may be required for clearance.

Details of Side Trusses and End Bearings for 100-ft. Riveted Through Truss Bridge—Common Standard, Harriman Lines.

beams are riveted to the bearing plates which are built up inside the channels forming the bottom chord and the bearing pins pass through the bottom chord and bearing plates. The end bearings, both fixed and movable, are the same as those used for the plate girder bridges. The weight of a span complete is 165,000 lbs.

Electric Tramways and the Carriage of Goods in Great Britain.*

BY ALFRED H. GIBBINGS,
M. Inst. E. E., A. M. Inst. C. E.

Within a period of less than seven years, the development of electric traction in Great Britain has been marvelously rapid. The rate at which Parliament has granted concessions for private enterprise, and the eagerness with which the municipal and local authorities have pressed forward in this matter, has been abnormal in comparison with the progress of any other undertaking of a similar class, not excepting electric lighting.

In 1897, the writer, in conjunction with the city surveyor of Bradford, drew up the first municipal electric tramway specification, and on July 29, 1898, the working of the first ten miles of municipally-owned electric tramways was successfully inaugurated. Prior to this the only electric lines of any considerable extent were those of the Bristol Tramways and Carriage Co., which commenced running electrically in October, 1895, and the Dublin United Tramways Co., which were opened in May, 1896.

At the present time there are no less than 153 electric tramways and light railways in the United Kingdom, with nearly 2,000 route miles in operation. Many of these are in groups, physically connected up and maintaining an interchange of traffic, and hence the possibility arises of conveying goods as well as passengers over these lines. Every Electric Tramway and Light Railway Order contains a schedule of the articles allowed to be carried and the maximum rates and charges for the conveyance of almost all classes of goods, animals and things which include such heavy pieces as boilers, stone, machinery, etc., of which any single piece may weigh over eight tons. In fact, such facilities are granted for the carriage of goods on electric tramway systems, that it is impossible to forecast the extent of the probable development in this direction in the immediate future.

It will be apparent therefore, that the very short time which has elapsed since the introduction of electric traction, has precluded any very striking progress on the "goods" side of these undertakings; indeed, in some cases, it has not been possible to meet adequately the demand of "passengers." On the other hand, however, it has been found that on many of the interurban and rural tramways, the traffic receipts from passengers have not been, and are not likely to be, sufficient to meet expenditure owing to the high initial cost of construction. The problem of goods traffic is thus, at the outset, confronted with two difficulties of an entirely opposite character. On the one hand the town systems are already overcrowded with cars and are earning enormous profits; on the other hand the urban and rural systems are handicapped by unremunerative capital and are limited in their scope and extent. It is true that this is only one aspect of the subject, but typical of many other difficulties which present themselves, and are the first and most important requiring solution, and it is clear that some compromise must ultimately be arrived at.

There will be no need to enumerate those towns which are fortunately situated in having good dividend-earning undertakings, but some instances of the opposite class may be cited here in order to indicate clearly the necessity which exists for them to use all their available powers in order to increase their earning capacity. The following tabulation shows the loss sustained in operation on a passenger traffic basis.

Loss on Electric Tramway Undertakings.

Names.	Commencement of electric running.	Length of line open, miles.	Deficit for 1904.
Aberdeen	1899	25	No profit.
Birkenhead	1901	23	No profit.
Blackburn	1899	24	£5,138.
Brighton	1901	13	£4,779
Burnley	1901	19	No profit.
Burton-on-Trent	1903	8	No profit.
Darwen	1900	6	£1,485
Farnworth	1902	7	£1,780
Halifax	1898	44	No profit.
Huddersfield	1901	35	£4,911
Ipswich	1903	12	£1,920
Lancaster	1903	3	£2,833
Leicester	Horse trams.	16	£1,330
Lowestoft	1903	6	£226
Northampton	Horse trams.	9	£392
Oldham	1902	28	£7,826
Reading	1903	13	£543
Rochdale	1902	5	£4,037
Rotherham	1903	9	£17
Southport	1900	19	£341
Warrington	1902	9	£783
Wolverhampton	1902	13	£2,366
Great Yarmouth	1902	5	£215

The position in which these undertakings find themselves is indeed unfortunate. Before commencement of operation it was almost impossible to tell with any degree of accuracy what the number of passengers per car mile would be, and hence the nature of these promotions has been highly speculative. When once this figure has been ascertained it is in most cases almost invariable from year to year and so, unlike most other business ventures, the tramway is absolutely circumscribed in its development. So far, however, we have been referring to passenger traffic alone. There remains yet one solitary hope to admit of these concerns being placed on a sound financial footing. That hope is in the carriage of goods.

Attention was first called to the potentialities of a goods traffic on electric tramway systems by passing the Light Railways Act, in 1896, which to all intents and purposes has in almost every instance been used to obtain electric tramway powers instead of applying under the Tramways Act, 1870. The Light Railways Act was passed with the special object of facilitating the transport of goods, but more particularly agricultural produce, from country districts to railway centers, canals, towns, etc. It has not yet fulfilled the object of its existence, but indirectly, through the construction of a large number of interurban tramways and light railways, it may ultimately do so.

In 1900—1901, the writer was interested in the development of the South Lancashire Tramways, which serve an area full of promise for the most successful growth of goods traffic, a careful canvass showing an enormous amount of road conveyance of a wide variety of goods. Papers by the writer were read on the subject before the British Association in September, 1901, and the Liverpool Engineering Society in January, 1902. The compilation of these papers necessitated enquiry into all sorts of conditions, pro and con, which exist in this country; into many similar cases on the continent and in the United States, where more progress has been made, and the discussions which arose at the reading of the papers brought out many novel and striking features. Several of these will be referred to further on in this article.

The next step has been a practical application of the powers which hitherto have lain dormant. It consists in the inauguration of a local parcels service on several systems, on some of which it has been very completely and extensively organized.

The undertakings which have made this attempt are: Manchester Corporation, Bradford Corporation, Dublin United Tramways Co., Ltd., Dundee Corporation, Edinburgh and District Tramways Co., Ltd., Huddersfield Corporation, Bury Corporation, Gravesend and Northfleet Electric Tramways, Ltd., Ipswich Corporation, Reading Corporation, Potteries Electric Traction Co., Halifax Corporation and the London United Tramways Co.

A full description of most of these schemes has appeared in the technical press, but it is not the intention here to describe or enlarge upon the details of a parcels service. It will suffice to remark that the Manchester Corporation has designed a special goods or parcels van, which runs between the passenger car services throughout the day. The van is almost identical with the type which has been used for many years by the Pittsburg Express Company, Pittsburg, Pa. It is a clear indication that the business will not be allowed to rest within the limits of parcel conveyance, but that when some of the more obstructive difficulties have been overcome, the carriage of goods will commence in earnest.

Beyond the movement in connection with parcels, very little has yet been done towards inaugurating a comprehensive goods service. The Huddersfield Tramway Department are carrying coals over their lines, and in 1901, the South Lancashire Tramways Co., appointed a goods traffic manager, but gave up the idea through want of capital.

At the annual meeting of the Potteries Electric Traction Co., on April 11, this year, the chairman, Mr. G. F. M. Cornwallis-West, said:

> "There had been an increase again in the parcels traffic, the number of parcels carried being 209,633, and the receipts had increased correspondingly. Other tramway undertakings, both municipal and otherwise, had taken up this important subject, and the Potteries Company had been the model in many instances upon which these systems had worked. It was to be hoped that in the near future it would be possible for these concerns to form some sort of combination whereby they could act as each other's agents in the districts they serve, and so enormously increase the volume of business, and thus reap the profits now obtained by intermediaries. The carriage of heavier goods was receiving the directors' attention, and application had been made to the local authorities with reference to the construction of sidings to facilitate such traffic, but so far unsuccessfully."

This undertaking is one of the large group of tramways associated with the British Electric Traction Co., and it may be assumed therefore that the foregoing speech indicates that the British Electric Traction Co. attach considerable importance to the goods traffic problem.

In enumerating the difficulties of inaugurating a goods service on electric tramways, no regard need be given to such objections as may be classed as æsthetic, constructive, or purely traffic troubles. These are simple and weigh but little in comparison with those of a more obstructive and real nature. Indeed, there are some which must be removed, notwithstanding the facilities and powers already conferred by the Acts and Orders, before any business can be done.

In the first place even the carriage of parcels has met with strong local oppcsition in Manchester, and has involved the corporation of Manchester in serious litigation on a question, the decision of which will be awaited with great interest.

When the scheme was proposed, it met with determined opposi-

*Reprinted from the July number of the *Engineering Review.*

tion from the private traders whose businesses it seemed likely to affect. A well-known parcel carrying firm of Manchester has now served a writ on the corporation in which they set forth the following claims:

(1) A declaration that the defendants have no power to convey, collect, or deliver by means of road vans, handcarts, or messengers; to act as general carriers or delivery agents, general forwarding or railway agents; or to undertake the collection of the value of goods on delivery.

(2) An injunction restraining the defendants from acting as above.

(3) A declaration that it is unlawful to spend money out of the city funds or the tramways receipts for any such purposes.

(4) An injunction restraining such spending.

(5) A declaration that it is unlawful to use the buildings, plant, and servants of the tramways undertaking otherwise than for strictly tramway business.

(6) An injunction restraining the defendants from such use.

The writ has been granted in the Chancery Division of the High Court, and the Tramways Committee gave the Town Clerk authority to defend the action.

Without attempting in any way to pre-judge the merits of this action, there can be no question but that it amounts to an admission that the tramway parcels service is a better and more expeditious service than the horse and van service, and hence becomes a serious competitor.

The other drawbacks may be summarized as follows:

(1) Co-operation with regard to interchange of traffic and through running powers by contiguous undertakings.

(2) Sidings from main lines and into private premises.

(3) Collection and delivery to and from places remote from the service lines.

(4) Trailers and marshalling.

With regard to the first, running powers necessarily implies two things. In the first place it is an arrangement by which the goods can be carried from point to point. Secondly, it is obviously necessary that the rail gages must be the same throughout, and that the method of haulage or traction should be identical. In other words, the systems must be the same in both cases. In the majority of systems of electric traction in this country the conditions are almost identical, with the exception in a few instances of gages narrower than 4 ft. 8½ in. The difficulty therefore resolves itself into the possibility of agreement or co-operation between two or more contiguous authorities. This is a portentous subject in itself, especially when one considers the usual type of rate-payer who figures conspicuously in all negotiations, whether the undertaking is owned by the local authority or by a company. Some attempt, however, has been made by a committee in Lancashire consisting of representatives from the Liverpool Corporation, other corporations, Liverpool Chamber of Commerce, Mersey Dock and Harbor Board, and mill owners, etc., to arrive at some common basis for the conveyance of goods over all the South Lancashire systems, including Manchester and the district east of it, bordering on Yorkshire. No report of the proceedings has yet been issued.

The next difficulty relates to the question of sidings into mills, collieries, railway yards and similar places.

A very real and immediate difficulty arises in obtaining the sanction to lay additional lines and sidings. It has been referred to in the speech of Mr. G. Cornwallis-West, quoted herein. It affects both municipal and private enterprise alike, although of course the private enterprise is in much the worse position, because it would frequently have to obtain the sanction of the local authority as a *sine qua non*. Under the existing legislation, therefore, it is possible for a local authority or private individual (as a frontager for instance) to withhold in the most arbitrary manner the consent which is necessary, to lay even a special siding into premises. Therefore, whether powers have been obtained under the Tramways Act, or Light Railways Act, the whole course of the original procedure of applying for powers has to be repeated for every additional line or siding required. It is at once apparent that such a condition becomes practically prohibitive in consequence of the costs and delays involved.

It is true that the Board of Trade can exercise very limited powers in this respect, but after a concession has been obtained in the usual way, it should not be allowed to remain practically impossible to obtain such reasonable and beneficial extensions, as special short lines to mills, and sidings from the predetermined track. This appears to the writer to be the most important obstacle to be removed, for it would also supply the key to many of the other difficulties. The difficulty might very well be dealt with on a similar basis to the laying of service lines from electric light street mains, provision for which (including extensions of mains) is made in the Electric Lighting Acts, 1882 and 1889.

The collection and delivery of goods to and from places remote from service lines or depots is a problem which can only be solved very gradually and in accord with the exigencies of the business to be done. Given the facility to lay additional sidings, and short extensions into mills, collieries, etc., much supplementary collection, etc., would be avoided. It must not be forgotten that the essence of economy in connection with the carriage of goods on electric tramways is the avoidance of loading and unloading several times in the course of one journey. Hence, whether the collection of goods is from points near to or remote from the system, some method of handling and transferring in bulk must be adopted. With the horse-drawn truck this has been a difficult, if not an impossible matter, but with the new motor trucks the transference and carriage is simplified. The platforms and upper portion of trucks should be identical, interchangeable, and readily removable from one to the other when fully loaded.

The employment of trailing cars is also not yet permitted by the Board of Trade. It is not anticipated that more than two or three trailers would ever be required, except perhaps in a purely local service in country districts. The employment of trailers involves shunting and marshalling, both objectionable and uneconomical methods, but nevertheless it would very often be a great convenience and great economy to make use of one or two trailers. So far, however, this is not permitted on lines in this country, but it is a common feature in the United States and on the Continent.

The advantages which would accrue from the utilization of electric tramways for the carriage of goods would be, broadly speaking, twofold. In the first place an increased revenue and reduced standing charges would result to the undertaking; and secondly a healthy competition would be set up between this departure and existing carriers, including the railway companies. Thus the local manufacturer, colliery owner, agriculturist, and tradesman would benefit by cheaper rates of transit for their goods and an incentive would at once be given to the improvement of local conditions and trade generally. When once the main obstacles to the initial start are removed, or at least considerably modified, and assuming the same rapid development as was experienced with electric tramways, it is safe to predict that this new boon will soon become a formidable competitor with railway companies, and therefore of national importance. High railway rates has long been a subject of strong complaint by all importers and exporters, both with regard to raw produce and the manufactured article, and until some form of competition, in the nature of cheaper rates and fairly rapid transit is introduced, no hope of a reduction is tenable.

There is, therefore, the very strongest reason why all local industries and rate-payers should assist in every possible way towards the inauguration of this most desirable facility.

The question that immediately arises is, how is it possible for tramways to offer cheaper rates of carriage than railways? If we take the capital cost of a tramway undertaking, we find that it is proportioned somewhat as follows:

Permanent way, overhead equipment, etc.	60 per cent
Generating station, car sheds, etc.	25 "
Rolling stock	15 "
	100 per cent.

From this it will be seen that the utilization of the permanent way would result in reduced standing charges to both passenger and goods departments to the extent of a large proportion of capital. Maintenance charges would still remain the same for both concerns, though in reality doubled due to extra wear and tear. The greatest economy, however, would arise from the through conveyance of goods, not necessarily on the same vehicle, but without rehandling in detail. Hence such charges as warehousing, service terminal charges (often the most serious and heavy charge of all), loading and unloading, and shunting costs, would be greatly reduced, if not totally avoided in the majority of cases. Incidentally such an arrangement should be also to the benefit of the railway. With properly constructed interchangeable truck bodies, goods could be transhipped in bulk to the railway, and thus the long distance goods traffic would be augmented and made more profitable.

Other indirect advantages are also possible. The increased traffic on the system will tend towards the reduction of the cost of electrical energy, by increasing the load-factor of the generating station. The difference may be represented as the saving between a 60 per cent. and a 40 per cent. load-factor, or in other words more than 20 per cent. more energy can be generated at the higher load-factor at the same cost. Another detail in economy is the saving in road repairs and maintenance to the local authority through lessened horse and motor truck traffic, and that this is likely to be of real importance, appears from papers read by eminent engineers and road surveyors.

Four Cylinder Compound Locomotives on the Paris-Orleans Railway.*

In February, 1903, the Orleans Railroad put into service on the Paris-Bordeaux division 23 new locomotives, eight of which, Nos. 3,001 to 3,008, are of the Atlantic or 4-4-2 type, and 15, Nos. 4,001 to 4,015, are of the ten-wheel, or 4-6-0 type. These locomotives were

*Abstract of article by M. P. Gonte in La Revue Générale for July, 1904. Translated by Lawford H. Fry.

built at the Alsacienne Company's works at Belfort, from designs prepared by this company and by the Orleans Railroad. Except that they are larger, these locomotives do not differ from the four-cylinder compounds put in service during the last few years by the Northern Railway of France, the Southern and the Eastern Railways and the Orleans Railroad. The increase in power was rendered necessary by the constant increase in the weight of the high speed trains. The maximum axle load is limited to 40,000 lbs. The Atlantic type locomotives, which have 79 in. drivers (2 in. tires) handle the expresses at a speed of 55 to 60 miles an hour, making the run from Paris to St. Pierre-des-Corps, a distance of 150 miles, and with one stop at Aubrais, and the run from St. Pierre-des-Corps, a distance of 217 miles, with two stops, at Poitiers and at Angouleme. The 4-6-0 locomotive haul expresses at a speed of 45 to 50 miles per hour with heavy trains and with frequent stops. They make the run from Paris to Tours, a distance of 150 miles, and from Tours to Angouleme, a distance of 133 miles, with numerous stops. These 4-4-2, or Atlantic type, and the 4-6-0, 10-wheel type engines, only differ from each other in the arrangement of the wheels and have boilers and cylinders of identically the same design. The grate area of these locomotives is 33.4 sq. ft. (122 in. x 39 in.). Experience has shown that this considerable length of firebox (122 in.) does not offer any difficulty in the firing if the grate has a slope of 12 deg. The heating surface is 174 sq. ft. in the firebox and 2,403 sq. ft. in the Serve tubes, making a total of 2,577 sq. ft., or approximately 77 times the grate area. The evaporative power of the boiler has shown itself to be high, the rate of combustion being 102½ lbs. of coal per square foot of grate area per hour, with a rate of evaporation of 8 lbs. of water per lb. of coal.

The cylinders are 14⅜ in. and 23½ in. diameter, with a 25-in. stroke, while similar locomotives built for the Orleans Railroad in 1900 had cylinders 14 in. x 22 in., with a grate area of 25.8 sq. ft.

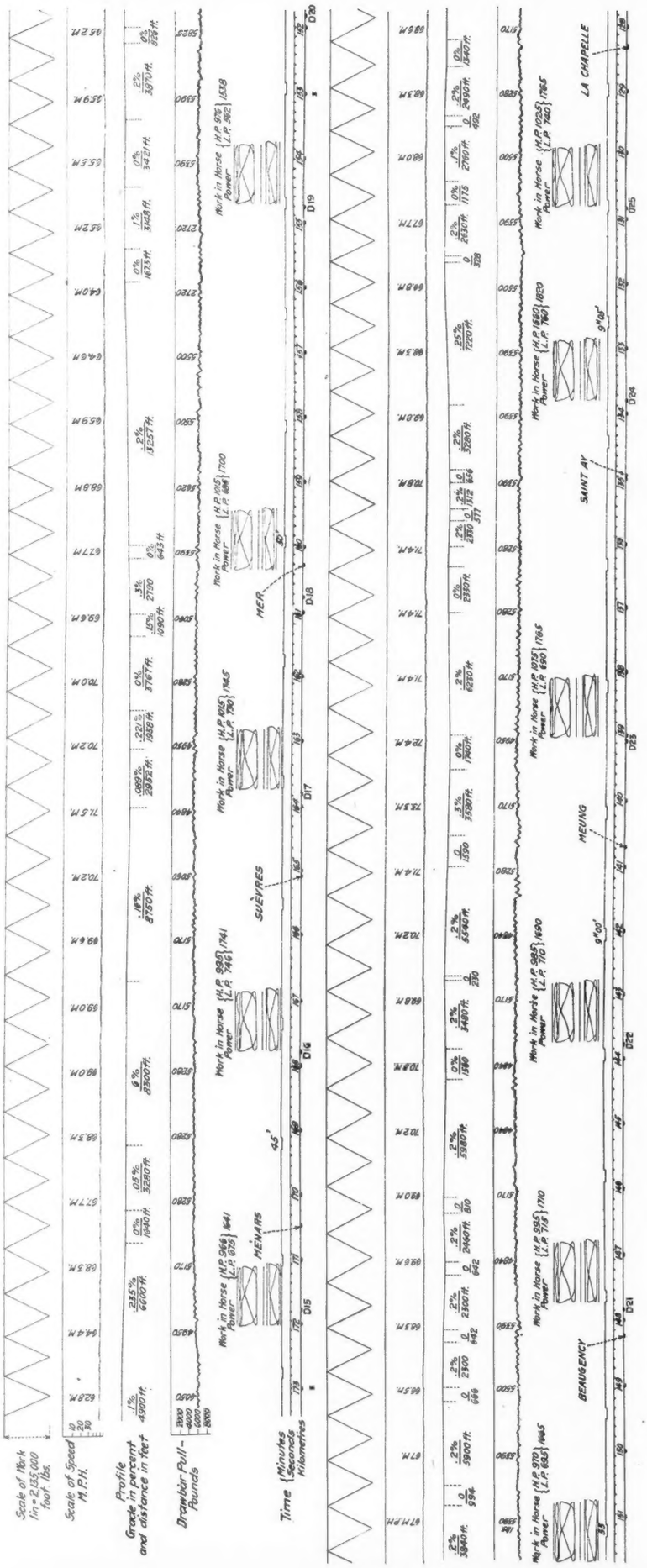
With a cut-off of 55 per cent. in the high-pressure cylinders at high speed the engine consumed all the steam generated by the boiler when burning from 100 to 110 lbs. per sq. ft. of grate with a fuel composed of half coal and half briquettes.

The high-pressure valves are of the balanced type, and the low-pressure valves are plain D valves.

The cylinders and steam pipes of these engines have been designed with the view of making the steam-passages as direct and of as large a section as possible. The high-pressure steam pipes are 4⅛ in. in diameter, while those of the receiver are 5⅛ in. in diameter. The steam ports are 14 in. x 1⅜ in. and 20½ in. x 1¾ in.

The indicator diagrams on the dynamometer record herewith show the efficiency of the ample sections given to the steam passages.

The wire-drawing at cut-off is decidedly less than in the previous locomotives, and it is not until the high speed of 70 to 75 miles per hour is reached that there is a drop of from 2 to 3 lbs. between the high-pressure exhaust and the low-pressure admission pressures. This arrangement enables the engines to run with nearly the same cut-off in both cylinders, say, 50 per cent. in the high-pressure and 55 or 60 per cent. in the low-pressure. Further, the pressure in the low-pressure steam chest can be kept down to about 7.7 lbs. per sq. in. and the work in the two cylinders nearly equalized.



Dynamometer Record for Part of Test No. 22 of Four-Cylinder Compounds on the Orleans Railroad.

The general dimensions of the locomotives are given below in tabular form:

Boiler.

	Locomotives 3000 and 4000.
Working pressure	227 lbs.
Grate area	33.37 sq. ft.
Length of firebox	122.0 "
Width of firebox	*39⅜ "
Slope of firebox	12 degrees.
Heating surface of firebox	174 sq. ft.
Heating surface of Serve tubes	2,403 "
Total	2,577 "
Proportion of heating surface to grate area	77.25
Volume of water	1,500 gals.
Volume of steam	766 "
Length of tubes between tube plates	14 ft. 6¼ in.
Mean diameter of boiler waist	59½ in.

Engine.

Cylinders—Stroke	25¼ in.
Diameter of high-pressure	14⅛ "
Diameter of low-pressure	23⅝ "
Ratio of volumes	2.78
Valves	High-pressure, balanced
Outside lap	2⅛ in.
Inside lead	¼ "
Maximum travel	5½ "
Dimensions of admission ports, h.-p.	14⅜₁₆x1⅞ in.
" " exhaust " "	14⅜₁₆x3⅛ "
" " admission " l.-p.	20½x1⅞ "
" " exhaust " "	20½x3⅛ "
Sectional area of steam pipe to h.-p.	13.3 sq. in.
" " " steam pipe to l.-p.	20.5 "
" " " exhaust l.-p.	58.9 "
Maximum sectional area of exhaust pipe	45.6 "
Minimum sectional area of variable exhaust	17.7 "
Proportion of volume of h.-p. valve chest to that of cylinder	1.18
Proportion of volume of receiver* to that of l.-p .cylinder	1.44

*Common valve chest and exhaust pipe from h.-p.

Wheels.

	Engines—No. 3000.	Engines—No. 4000.
Diameter of drivers (thickness of tire 2 in.)	78.8 in.	70.9 in.
Diameter of front truck wheels	46.25"	36.25"
Diameter of trailers	59.0 "	"
Distance between axles 1 to 2	90.5 "	90.5 "
" " " 2 " 3	69.0 "	69.0 "
" " " 3 " 4	84.5 "	78.8 "
" " " 4 " 5	98.5 "	86.5 "
Rigid wheel base	15 ft. 3 in.	13 ft. 9 in.
Total wheel base	28 " 6 "	27 " 0 "

Weight.

Distribution of weight, truck	44,500 lbs.	42,695 lbs.
" " " third axle	38,250 "	39,890 "
" " " fourth axle	40,690 "	39,890 "
" " " fifth axle	36,130 "	39,890 "
Total	159,660 lbs.	161,765 lbs.
Weight on drivers	77,775 lbs.	117,265 lbs.
Total length of engine	38 ft. 6 in.	38 ft. 2 in.

Tenders.

Tank capacity	5,300 gallons.	4,500 gallons.
No. of wheels	6	6
Weight, empty	42,095 lbs.	36,180 lbs.
Weight, in working order	99,425 "	81,585 "
Length of tender	24 ft. 2 in.	20 ft. 0 in.
Total length of engine and tender	63 " 0 "	58 " 3 "
Total wheel base	54 " 9 "	50 " 0 "

Results of Tests Carried Out on Locomotives of the 3,000 and 4,000 Series.

Tests have been made with locomotives No. 3,001 and No. 4,013 with the object of determining the power actually available in regular service with these two types of machines. The tests were carried out on the run from Paris to Tours (146 miles) and return, which was made in each direction with a single stop of 15 minutes at Auxbrais. This stop is almost exactly in the middle of the run. The trial train consisted of a dynamometer-car weighing somewhat less than 395,000 lbs., and which was described in the *Revue Générale* of March, 1903, and the *Railroad Gazette* of June 19, 1903, and loaded cars varying in number according to the weight desired for the test. These cars had two axles spaced 19 ft. 8 in. apart. They were loaded so as to weigh about 44,000 lbs. apiece. The amount of water and coal used were accurately noted during the run. The fuel used was a half and half mixture of Aniche coal and Somain briquettes.

Table 1 shows the averages obtained from the 32 tests run between Paris and Tours. The train loads ranged from 242 tons to 385 tons (2,000 lbs.) behind the Atlantic type engine No. 3,001, and from 385 to 536 tons behind the 10-wheeler No. 4,013. The trains were run at nominal speeds of 59, 56, 50 and 47 miles an hour. The results obtained are referred to the horse-power at the periphery of the driving wheel. This has been calculated by deducting, in each case from the indicated horse-power, the power required to move the engine and tender, which was determined from a series of tests made by running the locomotive with steam shut off, as explained below.

It will be seen that the power of the 10-wheeler No. 4,013 was not so fully utilized as that of the Atlantic No. 3,001.

The averages given in Table 1 are supplemented by the figures given in Table 2 for the maximum tractive effort, and the horse-power which were developed on stretches of from six to 28 miles in length with trains of 365 tons with the Atlantic type and 536 tons with the 10-wheeler.

The dynamometer car records for the part of test 22 which gave these maxima are reproduced in the accompanying illustration.

The Atlantic type engine No. 3,001 with a train of 385 tons over a distance of eight miles with short rising and falling grades of not over 0.25 per cent. maintained an average speed of 69.6 miles an hour; the average drawbar horse-power was 913, and the average at the drivers was 1,650 horse-power.

The indicator diagrams are shown on the dynamometer record at the points where they were taken. The maximum indicated horse-power is 1,860.

On the Etampes grade of 0.8 per cent., which is 6.8 miles long, the Atlantic type with 385 tons averaged 53.4 miles an hour, developing 986 h.p. at the drawbar and 1,500 h.p. at the drivers.

Averages from 32 test runs made between Paris and Tours (146 miles) with one stop of about 15 minutes.

TABLE 1.—Locomotive No. 3001.

Weight of train.*	Average speed, exclusive of stops.	Average H.P. Drawbar.	Average H.P. At driving wh'l. tire.	Water consumed per hour. Per drawbar H. P.	Water consumed per hour. Per H.P. at drivers.	Coal burned pr sq. ft. of grate per hour.	Lbs. of water evaprated per lb. of coal.
242	57.6 m. p. h.	481	970	47.4	23.6	82.0	8.31
282	60.2 "	593	1,108	41.8	22.4	97.3	7.72
330	57.9 "	580	995	43.1	25.1	88.1	7.98
387	57.40 "	700	1,130	39.7	24.0	106.0	7.68
		Locomotive No. 4013.					
387	54.7 m. p. h.	620	1,069	41.2	23.8	96.7	7.89
431	53.12 "	628	1,022	41.6	25.5	107.0	7.24
541	47.76 "	628	942	37.6	25.0	101.0	7.047

*In tons of 2,000 lbs.

Averages from 32 test runs made between Paris and Tours (146 miles) with one stop of about 15 minutes.

TABLE 2.—Locomotive No. 3001.

No. of test.	Distance considered.	Percentage cut-off, H.-p.	Percentage cut-off, L.-p.	Average speed, m. p. h.	Average drawbar pull in. lbs.	Average horse-power At drawbar measured by dynamometer car.	Average horse-power At drivers calculated.
15	18.64	50	65	66.2	4,840	856	1,440
16	27.96	50	65	66.5	4,800	854	1,455
17	18.64	52	65	67.7	4,840	876	1,495
18	18.64	53	63	67.7	4,800	866	1,505
19	24.85	50	62	66.8	4,800	856	1,468
19	18.64	50	62	69.6	4,680	868	1,522
20	18.64	50	65	63.7	5,540	943	1,520
20	12.43	55	65	57.8	6,320	970	1,450
20	6.21	55	65	65.5	5,560	976	1,580
21	12.43	53	70	62.8	5,810	974	1,495
21	12.43	53	65	66.5	5,190	922	1,509
22	22.99	53	65	67.9	5,140	933	1,570
22	8.08	53	65	69.6	5,170	960	1,650
22	27.96	53	65	67.1	5,165	940	1,580
22	8.67	55	65	65.2	5,500	957	1,554
				Locomotive No. 4013.			
29	17.34	43	68	54.7	5,280	773	1,194
30	10.56	55	65	48.0	5,630	705	1,045
31	13.67	45	60	54.4	5,080	735	1,168
32	11.19	50	65	52.5	6,420	897	1,336

APPENDIX.

Method of Calculating the Rolling Resistance of the Locomotive and Tender.

The dynamometer car records show the amount of work utilized at the drawbar, and in order to determine the total amount of work it is necessary to add the work consumed in the propulsion of the locomotive and tender which is made up as follows:

1. Work done in overcoming gravity.
2. Work done in accelerating or retarding.
3. Work done in overcoming the resistance of the locomotive and tender.

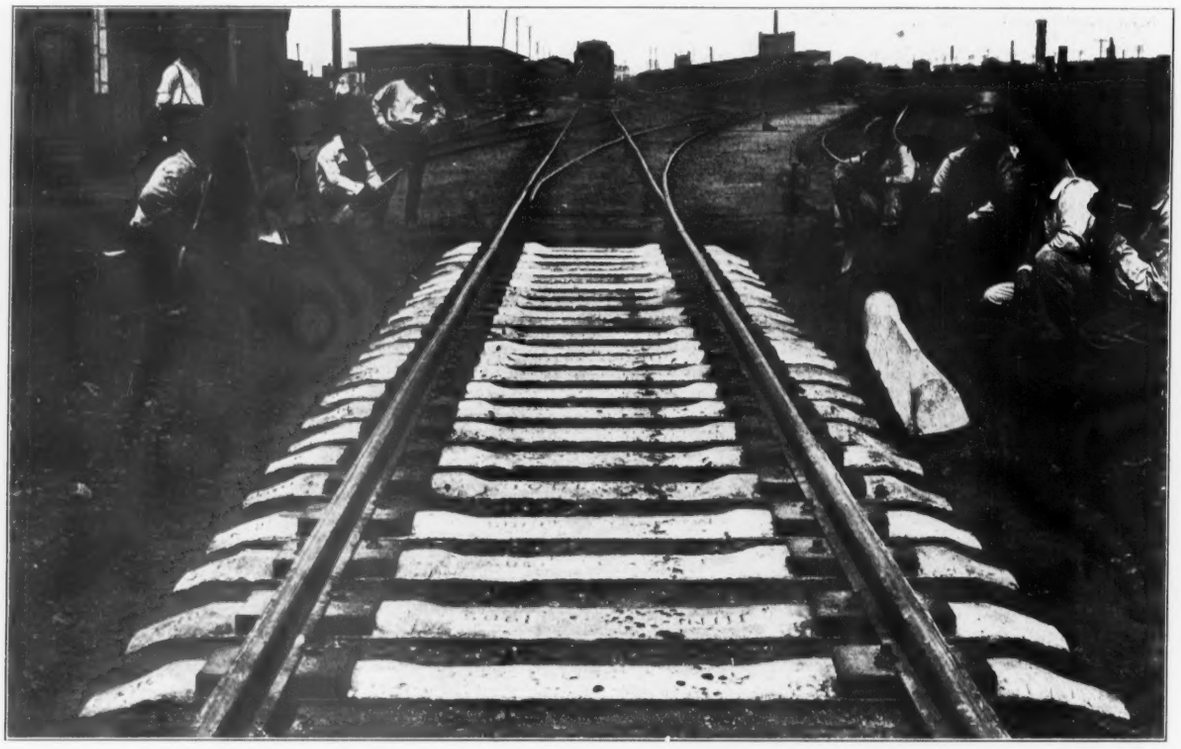
When the engine is running with closed throttle, the resistance is the only quantity not capable of direct measurement.

The drawbar work is given by the dynamometer records; the work done in overcoming gravity is determinable from an examination of the profile of the road, and the work of acceleration is easily calculated from the recorded changes of speed. These quantities being known the only unknown is the resistance of the locomotive and tender which can be easily calculated, as the relation linking all these quantities together is known.

The laborers pension fund of the Prussian State Railroads amounted at the end of 1903 to about $6,950,000 for one division, to which 247,733 men contributed; and to about $15,300,000 in the other division, which had 200,328 men belonging to it. This is a capital of $28 per man in the first division and $76 per man in the second. The contributions per man to these funds in 1903 were $1.58 and $3.14 in the two divisions respectively, an equal amount being contributed by the railroad management. Invalid and old age pensions and sick allowances were paid to 11,841 persons in the first division, only 174 of whom had sick allowances; the invalid pension averaged $43 per pensioner; the old age pension a little less. The management of this fund has the right by law to dictate the treatment of invalid pensioners, and it made extensive use of this authority in 1903, especially in the case of consumptives, who were sent to sanitaria, early notice being given of their condition. In these cases allowances were paid to the families of invalids. In 1903, 953 persons were treated at an average cost of $70 each. Of the 553 consumptives so treated no less than seven-eighths were so benefited that they became wage earners again. This, it must be remembered, is a laborers pension fund. The regularly appointed employees are otherwise provided for. There are also various sick funds covering limited classes or districts.

The Percival Concrete Tie.

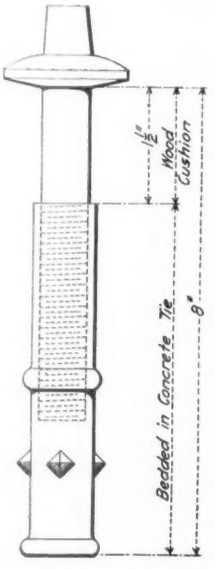
The accompanying illustration shows a number of Percival reinforced concrete ties laid in the track of the Galveston, Houston & Henderson at the entrance to the Galveston, Tex., yard. The form of tie has been patented by H. E. Percival, of Galveston, and this short experimental section has been laid with them to determine



Percival Concrete Ties in the Track of the Galveston, Houston & Henderson at Galveston, Tex.

their strength and wearing qualities under heavy traffic. They have been in the track now about a month and have shown no signs of failure or needed any attention whatever.

The ties are moulded in one piece and are reinforced with Johnson corrugated steel bars and steel wire. Their general shape is clearly shown by the loose tie at the side of the track. The dimensions are 8 ft. long, 9¼ in. wide on top and 9 in. deep. The ends for two feet of the length are made with a parabolic cross-section to give greater bearing surface under the rails, but in the center the tie has a V shape to make it self tamping and to relieve the center binding pressure, which is always present with a flat bottom tie. The reinforcement consists of three ½-in. bars bedded near the top surface and a ¾-in. bar bedded near the apex of the triangular section. Every 16 in. of the length a steel wire is bound around the longitudinal bars to give further reinforcement from crushing. The ties weigh 385 lbs. and cost about $1.60 to make.



Screw Spike and Socket for Percival Concrete Ties.

The bearing for the rail and the form of fastening are essential details of the Percival tie. The top surface of the concrete is recessed out under each rail to take a hard wood block 2 in. x 9 in. x 14 in. which has previously been treated with a preservative. This block forms an effective cushion to prevent the concrete from crushing under the action of heavy wheel loads and poor counterbalance. In the body of the tie are bedded composition Babbitt metal and galvanized steel screw sockets, and the spikes for holding the rail are screwed down through the cushion blocks into these sockets. The sockets, being thoroughly protected in the concrete, will last indefinitely, and renewals of worn or corroded spikes can be easily made. The spikes are of approximately the same form of head as those used on the French Eastern Railway, and are ⅞ in. in diameter and 10 in. long. The spike illustrated is similar in design, but smaller.

What is the Best Method of Painting Steel Cars?*

BY F. P. CHEESMAN.

The committee appointed by the Master Car Builders' Association on What is the Best Preventive of Rust on Steel Cars? reported at its 1904 convention as follows:

First.—For New Cars: (a) The steel should be thoroughly cleaned of all rust and furnace scale before the car is assembled. (b) All joints before assembling should be thoroughly coated with coal tar. (c) After car is assembled all grease should be thoroughly removed from the steel and same given a good coat of carbon or graphite paint on the outside and underneath, and the inside a heavy coat of crude petroleum, coal tar applied hot, or some similar substance. (d) The outside to be given a second coat of graphite or carbon paint, as may be desired.

Second.—For Old Cars: (a) All scale and rust should be removed wherever it appears on the car, by steel brushes or scrapers, and in the case of the inside of the car by any of the above methods or by the use of pneumatic hammers or mauls. (b) After all scale and rust have been removed the car should be thoroughly cleaned with steel scrapers or wire brushes and blown out with air, in order to present a clean surface for the paint. (c) The methods of painting recommended for new cars should be followed out in the case of old cars, after a clean surface is obtained.

The following report was made at the 1904 convention of Master Car and Locomotive Painters by a committee especially appointed to draw up the best specifications for painting of steel cars:

"It is the sense of this association that, in the construction and painting of steel cars the following points are of vital importance to their preservation:

"First.—All flash or mill scale, rust, oil, grease and dirt should be entirely removed from all parts entering into the construction of cars before any paint is applied. We believe that this can be best accomplished by the use of the sand blast.

"Second.—During construction all overlapping joints, wherever metal is placed upon metal, should be thoroughly coated with a heavy mixture of moisture-repelling paint.

"Third.—The initial painting, being of the greatest importance, should be done in the best possible manner. The first coat should be applied immediately after metal has been sand-blasted and before the cleaned surface can accumulate rust.

"The material should be of an elastic nature and sufficient time should be allowed between coats for drying. It should be put on evenly in a workmanlike manner.

"Fourth.—We believe that not less than three coats should be applied to all exterior parts of body, including underframing, and

*Paper read at the Atlantic City meeting of the American Society for Testing Materials, June 30, 1905.

two coats on interior of body; also all parts of trucks except wheels and axles.

"Fifth.—We recommend a rigid inspection of the cleaning and painting of cars under construction by competent, practical men, believing this in the line of economy.

"Sixth.—We would suggest that the abuse of cars in service be stopped by discontinuing the loading of the hot slag, billets, etc. Also that the hammering of side sheets and other injurious methods used to facilitate unloading be discouraged.

"Seventh.—In the repainting of cars, all corrosion and loose paint should be removed with steel scrapers and wire brushes or the sand blast, and not less than two coats of an elastic preservative coating applied to all cleaned parts. As the greatest loss from corrosion is found on the interior parts of coal-carrying cars, we would consider that matter of painting those parts worthy of serious consideration."

We agree largely with the above reports and will consider the subject under two headings: First, as applied to "New Cars Constructed by Steel Car Builders," and second, as applied to "The Repainting of Cars by Railroads."

Under the first heading, we desire to call your attention to the fact that the conditions as we find them now are such as make it impossible to secure a good job of painting, and it is simply money thrown away to attempt to furnish first-class material for the work as it is now done.

In nearly all the large car shops it is the practice to put on two coats of paint in one day, followed usually by the stenciling of the cars that same day. It is unnecessary to state that under these conditions neither adequate protection nor durable results may be expected, but until the present methods are changed we must meet them as they exist, and do the best possible under the circumstances. We believe that better results can be obtained by the application of only one coat rather than the forcing of the two coats to dry so that they can be applied inside of 12 hours. We therefore suggest that in specifying paint for new steel cars when not more than 12 to 24 hours is allowed for painting that only a single coat be specified, and that care be taken to see that the surface to which this coat is applied is properly prepared by removing all rust, mill scale, grease and dirt by sand-blasting; that this work be done under close inspection and that the paint be applied immediately after the sand-blasting as new rust will accumulate in a very short time.

For this one coat work the pigment base of the paint should be pure blue lead. Theoretically the vehicle ought to be only pure raw linseed oil, but as conditions make this impossible a pure selected turpentine drier should also be used. This drier should be of such a nature as to act both as a binder and a drier, and only enough should be used to dry in the required time which for satisfactory results should not be less than ten hours. All overlapping joints which cannot be reached to be repainted, to be coated with a heavy coat of blue lead made in semi-paste form. This shop coat should be followed in the course of six months with two coats of paint, at which time all rust to be removed by scraping and with wire brushes and the abrasions repainted with blue lead. The main reason why we suggest blue lead in this connection, in preference to any other pigment for first coating, is that our experiments seem to prove conclusively that rust will not progress or extend under blue lead, hence it is only necessary to remove the rust that is visible, whereas in the use of any other paint pigment we find that the rust spreads under the paint for quite a considerable distance, and as it is covered and not visible it usually is not removed. Blue lead for single coat work stands weather exposure better than other pigments, and is not affected by sulphurous or carbonic acid gases, which are very injurious to red lead. Carbon black will not answer for single coat work, as it will not cover with as heavy a coating as is necessary to withstand abrasion, and it also takes too much drier when required to dry in such a short time as say ten hours. Graphite when used for single coat work does not give durability, as under the conditions of ordinary application it is made to cover too much surface, hence the coating is thin, and the pigment seemingly repels the vehicle, leaving many minute holes, causing corrosion.

We quote from a paper by H. M. Butts, Master Car Painter, New York Central Railroad, read at a meeting of the Central Railroad Club of Buffalo: "We must admit that the combination of red lead and linseed oil properly used has served its purpose long and well, but experience has demonstrated that it has its faults, for it is not a success for finishing coats. Red lead, being too strong a pigment for the carrying vehicle, the paint soon becomes hard and brittle and in time will chalk off. In this state it is pervious to moisture, which will soon penetrate to the metal and cause corrosion. Therefore, in order to obtain better and more lasting results the red lead must be covered with a coating which carries a pigment fine enough to fill the pores of the oil, thus forming a more elastic and non-porous surface. If an elastic coating is preferable for finishing coats, why not for priming coats as well? This, I think, is coming to be understood as the better way and hence red lead, which has stood in the front rank so long, is gradually being superseded by other pigments." We, of course, would prefer to have the cars properly painted when built, but under the present limited trackage that exists, in and around the car shops, it seems impossible to keep the cars for a long enough time to properly paint them, and again it frequently happens that the mill scale cannot be removed properly at the time the cars are built and until the mill scale does separate from the steel it is impossible to obtain a durable job of painting. Hence, if matters could be arranged so that at the end of say six months the car could be thoroughly overhauled and painted, a much more durable job would then be obtained.

As a rule the dryer used at the car shops is not of the quality that it should be, and while they are usually very particular to see that the linseed oil is pure, the large amount of dryer added (in many cases as much as two gallons of dryer to one gallon of oil), destroys completely the life of the oil and makes the paint so brittle that in some instances it commences to peel within two weeks after it has been painted. By applying only one coat we would be able to double the drying time, and consequently more than double the life of the paint, at a lower expense than by forcing on two coats in less than one-half the necessary time.

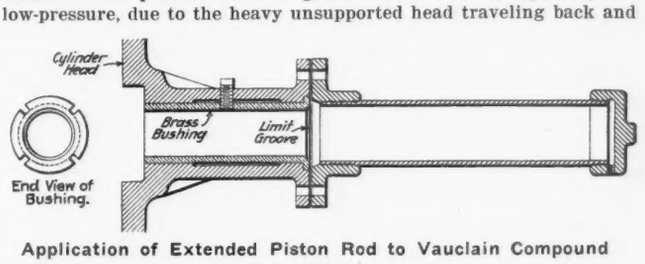
Under the second heading, "The Repainting of Cars by Railroads," our first choice would be, after the surface is put into proper condition by the removal of all rust and the retouching with blue lead of all bare spots, a coating of a paint made approximately of about 50 per cent. pure carbon black, 15 per cent. of pure white lead, 15 per cent. of pure white zinc, and 20 per cent. of selected inert pigment, non-hygroscopic in its nature, and the vehicle to consist of pure linseed oil and selected dryers. If the color of this paint is suitable we would recommend the use of two coats of it. If, however, the road prefers to use its standard shade for a finishing coat, it should not be made up in the same manner for use on steel cars as when intended for wooden cars. We also consider it of special importance both for the shop and the finishing coats that the size of the brush used should be specified in the original specifications, and that a larger brush than a 6 deg. round brush should not be allowed and particular care should be taken to avoid the use of a flat wide brush such as is now generally used for this work. In working with a wide flat brush workmen cannot brush the parts in and on as well as it should be done.

In regard to the interior of the car it should be painted when built with one coat of the blue lead paint, and the bottom of the car should be protected with a heavy wooden floor, arranged so as to be readily removed when the car is repainted, at which time all the rust on the interior would be removed, and two coats of paint applied, the first of blue lead and the second of a paint made along the lines of the formula used by the P. R. R. for their standard red freight car color. The cars are usually not painted under cover, hence we have very unequal results regarding durability. The sand-blasting and painting should be done under cover, especially in the case of the priming or foundation coat.

Extended Piston Rods on Union Pacific Vauclain Compounds.

BY G. H. LIKERT.
Assistant Master Mechanic, Union Pacific.

The Vauclain four-cylinder compound locomotives in service on the Union Pacific are of the 2-8-0 and 4-6-0 type, and when received were equipped with a non-extended piston rod, having a cast-iron head, bored out, with a shell approximately ¾ in. thick. The low-pressure piston heads were 26 in. in diameter, 4¾ in. thick, weighed about 390 lbs. and had cast-iron snap rings ¾ in. by ⅝ in. The high-pressure heads were 15½ in. in diameter, 4¾ in. thick, weighed about 180 lbs. and had the same size snap rings as the low-pressure heads. These pistons caused a great deal of trouble, especially the low-pressure, due to the heavy unsupported head traveling back and



Application of Extended Piston Rod to Vauclain Compound Locomotives.

forth in the cylinder. The difficulties experienced may be summed up as follows:

(1) Piston heads would break frequently, the result being that a cylinder head would be knocked out, the barrel of the cylinder cracked, or a piece of the cylinder broken out. This could be due to three things:

(a) Defective piston heads caused by the core having slipped when the casting was made, leaving one of the walls of the piston head very thin; or by poor material in head.

(b) Heating of head due to improper lubrication.

(c) Failure on the part of the roundhouse forces to make proper and regular inspection of heads.

The foregoing items were the most expensive of all, as several cases happened where the cylinders were so badly broken that they could not be patched.

(2) It was found that the cylinders were becoming badly worn out of round, necessitating frequent truing up or bushing of same. On account of the cylinder becoming out of round, the full service could not be got out of the piston heads, as the head would be fitted to the smallest diameter of the cylinder and it would only be a short time until an examination of the packing was required, and invariably it would be found that the trouble was due to the head being too small for the oval-shaped cylinder.

(3) It was necessary to increase the cylinder packing inspection from one to two or three times a month, in order to reduce the danger to a minimum.

(4) The greater friction of the heads in the cylinders made more oil necessary, thus increasing the cost of lubrication.

(5) Annoyance due to the piston rod packing blowing. Frequent renewing of packing was necessary as it was impossible to keep the piston head central with the cross-head and the piston rod therefore ground out the packing.

(6) Delay to power on account of being held for repairs. Also, slow turning of power at the various roundhouses and delays to trains on the road on account of engine failures and packing blowing.

As a result of the foregoing difficulties the cost of operation on these locomotives was very high and means had to be devised to reduce this cost.

About July 1, 1903, the company began equipping a few of the locomotives with extended piston rods, the accompanying drawing showing the method of application. The cylinder head, extension and brass bushing are shown. The brass bushing is turned, bored and fitted so that it can be applied or removed freely by hand. There is a ⅛-in. limit groove in the end of the bushing to gage the wear of same, and as soon as the bushing is worn to this limit, it is turned one-quarter turn. This is done until the bushing has been turned four times, when a new one is applied. The life of these bushings averages about six months.

From the very start it was apparent that the extended rod was the solution of the problem. Since applying the extended rod no cause has been found for removing the piston head except in case of accident, while the average life of the head on the non-extended rod is only about three months. The rocking wear on the cross-head is entirely eliminated, and there is less strain on the guides as the piston is supported at both ends of the cylinder. The guides also require closing less frequently. The life of the piston rod packing is greatly increased, as the packing supports practically no weight. It is seldom now that the piston rod packing on an engine blows. The cylinder packing and piston heads are now examined every 30 days.

The wear on the walls of the cylinder is hardly noticeable and we have only had one cylinder broken since using the extended rods. This was due to defective material in the piston head. A very appreciable saving in oil has also been made, as engines are now making 25 miles more per pint of cylinder oil than formerly. With the extended piston rods, the heads are turned ½ in. smaller than the cylinder. This allows the wear to come on the cylinder packing rings and the barrel of the cylinder.

Japanese Railroads.

The Imperial Railway Bureau of Japan has issued its annual report for the year ended March 31, 1904, which shows that the total length of railroad open for traffic at the end of the year was 4,496 miles, of which 1,345 miles was government railroads and 3,151 miles private railroads. Very complete traffic statistics for each separate railroad, government or private, the totals for all government railroads, the totals for all private railroads, and the grand total on all roads, are given. These show that the average train on all roads consisted of six passenger cars and nine freight cars, a total of 15 cars for each train. On the government railroads the average mileage of each passenger was 24.10 miles, and of each ton of freight 81.62 miles. On the private lines the average passenger journey was 15.18 miles and the average freight haul was 51.73 miles. On the government roads the average receipts per passenger per mile were 0.765 cent, and per ton of freight per mile one cent (2 sen= 1 cent). On the private roads the average receipts per passenger per mile were 0.735 cent, and per ton of freight per mile 0.88 cent. The passenger traffic on all roads was largely third-class. In each one thousand passengers four traveled first-class, 50 second-class, and 946 traveled third-class. The freight traffic is classified into the following four groups: Luggages; common parcels; corpses, precious goods and animals, and goods. Of each 100 tons of goods on government railroads 10.8 tons were carried under general tariff, 3.1 by special contract and 86.1 by carload rates. On the private lines, per 100 tons of goods, which includes the third classification, 9.2 tons were carried by general tariff, 25.4 by special contract and 65.7 by carload rates. In 13 years the total passenger traffic has grown from 470,300,633 passenger miles in 1890, paying $2,574,558, to 2,036,557,666 passenger miles paying $15,227,781 in 1903. The freight traffic has increased from 1,560,206 tons in 1890 to 17,761,312 tons in 1903.

In 1872 there were only 16 miles of government road in operation. In 1883 this had increased to only 100 miles. In that year the first 48 miles of private line was built. In 1890 there were 550 miles of government road and 717 miles of private road in operation. The average net earnings per mile of line for all roads were in 1883, $3,419; $1,516 in 1890, and $3,364 in 1903, which seem to indicate a very general prosperity. The revenue and expenditure table shows that a number of roads pay above 10 per cent. and one 14 per cent. dividends. The striking fact, as compared with an American railroad, is that from the standpoint of earnings, the passenger traffic is of much more importance than the freight traffic, a difference similar perhaps, though much greater, than that existing not many years ago on one of our American railroads in thickly populated territory. On the other hand the average earnings per unit per mile appear to be greater from freight than from passengers. The report has several admirable statistical tables which show graphically by diagrams and colors the increases in mileage, traffic, earnings and expenses of the two classes of railroads separately and as a whole. The railroad map of Japan shows that the government controls the only existing line through the center of the island. The existing line runs from Tokyo through Yokohama and along the eastern shore of the island through Kyoto to Osaka. Judging by the cities it reaches this seems to be the most important, though not the longest, of the through routes. By using both government and private roads it is possible to travel practically from one end of the group of islands to the other. The following table shows the principal statistics for both government and private roads. The yen has been taken as equal to fifty cents in United States currency:

	1904.	1903.
Miles Open: Government	1,345	1,226
Private	3,151	3,012
Total	4,496	4,238
Miles under construction	1,194	.....
Cost: Government	$139,366,330	.....
Private	226,611,643	.....
Total	$365,977,973	$352,462,382
Total: Locomotives, number	1,544	1,428
Passenger cars, number	5,101	4,864
Freight cars, number	22,735	21,459
Train mileage	34,294,358	32,066,079
Gross Earnings: Government	$10,054,558	$9,168,291
Private	17,736,105	16,622,107
Total	$27,790,663	$25,840,398
Expenses: Government	$4,948,450	$4,533,083
Private	8,187,300	8,101,612
Total	$13,135,750	$12,634,693
Net Earnings: Government	$5,106,107	$4,635,209
Private	9,548,805	8,570,495
Total	$14,654,902	$13,205,694
Passenger Earnings: Government	$6,296,450	$5,760,211
Private	8,931,321	8,548,685
Total	$15,227,781	$14,308,895
Freight Earnings: Government	$2,854,424	$2,526,744
Private	6,531,281	6,076,330
Total	$9,385,705	$8,603,073

Foreign Railroad Notes.

The entire Hungarian cabinet resigned lately, and with it the Minister of Commerce, Hieronymi, who was in charge of the State Railroads. He was succeeded by von Vörös, a man 56 years old, 34 of which he has spent in the office of the Ministry of Commerce. A number of other high railroad officers have been changed.

The Egyptian State Railways will expend this year about $3,500,000 on additional motive power, rolling stock and improvements to permanent way. Of this sum $750,000 will be spent for new locomotives, $700,000 for freight cars and $650,000 for passenger equipment. For renewals of rails, ties and new ballasting $375,000 has been appropriated.

The Prussian Minister of Public Works in an address to the Prussian House of Lords gave as follows the net earnings of the State Railroads, in millions of marks:

1901.	1902.	1903.	1904.
518	541	612	633

The capital invested has increased meanwhile, but not in proportion to the profits, which have been the following percentages on the investment:

1901.	1902.	1903.	1904.
6.41	6.54	7.12	7.19

Times were bad in the first two of these years, and began to recover in 1903.

GENERAL NEWS SECTION

NOTES.

At the high school in Altoona, Pa., a special course of instruction is to be established for boys who intend to become apprentices in the railroad shops.

The Chicago, Milwaukee & St. Paul announces that no stopovers are to be allowed on tickets between points in the state of Wisconsin. This order is said to have been made to avoid violation of a new law of that state.

Mr. R. E. Kerkam has been appointed Chief of Police of the Long Island Railroad. It is said that the policemen, detectives and watchmen of the road are to be organized on a plan similar to that which is in use on the Pennsylvania Lines west of Pittsburg.

The long pending litigation against the Southern Pacific Company in Kentucky, concerning the taxes claimed from the company in that state, is still alive, and, as appears from a motion made in the County Court at Louisville, July 17, the amount now claimed by the state (or the county) is $12,000,000. The statutory penalties for non-payment would increase this sum to twenty-one millions.

The Consul General of the United States at Halifax reports that during the past year the government of Canada has paid out $98,930 in commissions to agents who induce people in other countries to emigrate to Canada. In the United States the commission paid is three dollars for each man, two dollars for each woman, and one dollar for each child induced to go as agricultural settlers to western Canada, and commissions were paid to 76 different agents. The amount paid in the United States was $14,428.

Protection vs. Free Trade in Georgia.

One of the railroad commissioners of Georgia having given out that the commission, in regulating freight rates, would endeavor to protect manufacturers of that state against outside manufacturers, the Savannah *News* favors the commission with the following lecture. From what has appeared in the Georgia papers during the past few weeks, it seems that the merchants of Savannah are well satisfied with the present low interstate rates, while those of Atlanta are trying to find some way either to have interstate rates advanced or to have intra-state rates reduced. The *News* says:

"If the state had wanted the Commission to do anything of that kind, wouldn't it have so stated in the law creating the Commission? Where does the Commission get its authority to adopt a policy of protecting manufacturers? As a matter of fact, has it any such authority? Is not the policy it has adopted a wholly arbitrary one?

"The Commission was created for the purpose of protecting the people against unreasonable and discriminating rates, not the manufacturers against outside competing manufacturers. Suppose every other state railroad commission should adopt the policy that the Georgia Commission has adopted, what a complicated and annoying condition of affairs there would be. Georgia's manufactured products couldn't get outside of the state and the manufactured products of other states couldn't get into the state. At least the effect of the policy would be to bring about that condition of affairs.

"It may be that some of the manufactured products of Georgia have a hard time to compete with similar manufactured products of other states, but, if so, it is because they are manufactured under unfavorable conditions. There are products manufactured in Georgia that are made cheaper than they can be made in other states, and so they take the markets in other states. For instance, there are certain kinds of cotton goods manufactured in Georgia at less cost than they can be manufactured in New England, and hence they undersell the same class of cooton goods in the New England market. Suppose the New England States should adopt freight rates that would shut these goods out of their market, would Georgia regard that as fair dealing? We think not. If the policy of the Georgia Commission should be generally adopted, interstate commerce would be brought practically to a standstill; that they haven't adopted any such policy shows that it isn't either good policy or permissible.

"And how lame and impotent is Commissioner Brown's argument in respect to jobbers. He hopes that their business will not be injured by the Commission's policy, but, if it is, their remedy is to deal only in products manufactured in the state. How preposterous! Jobbers must deal in what their customers want. It is not their business to dictate to the people what they shall buy. If the Commission didn't want to hurt the jobbers outside of Atlanta, why did it give the jobbers of Atlanta the same rate as it gave the manufacturers of that city? Why did it discriminate in favor of the Atlanta jobbers? The fact that it gave jobbers of Atlanta the same rate it gave Atlanta manufacturers shows that its aim was to discriminate in favor of Atlanta.

"And it seems that the Commission is afraid to defend its alleged policy. The report is that the Attorney-General intends to plead that the acts of the Commission can't be reviewed by the courts, that the Commission is above the courts and can do as it pleases. It will doubtless find out before this matter is settled that there is power somewhere that can prevent rank injustice being done and make it clear to the Commission that it has altogether misunderstood its business and the scope of its authority."

The Gentle Art of Hustling.

"Must be a good hustler." What an ejaculation of scorn and contempt would the average British engineering shop or machinist foreman a few years ago have uttered on seeing this sentence interwoven in the "Wanted" column of an engineering journal or daily newspaper. Even now, when so much of the Americanising methods have been introduced into many of our works, it carries an ill-odor with it to our more or less tender dictionary palate. When our young mechanic or engineer first sees the word, he pictures some huge monster of physical inhumanity, whose possession of brute force far outweighs his mental capacity or attainments, let loose in a works where each employee is in daily or hourly fear of coming under the terrifying ban of one who rules by curses if not by blows, where reason is entirely absent, where mistakes or blunders are never forgiven, and where brute force always triumphs over and effaces any finer feelings that a man may possess. The dictionary meaning of the term tends to this exaggerated idea. To hustle is "to crowd upon so as to shove about roughly; to push or elbow out or about rudely; to jostle." But what a mistaken idea that is of a successful hustler. For the wrong application of this term we must condemn our American brethren, for in this, as in many other words, an exaggerated term is used by them where a more modest and strictly truthful word could have been chosen. The successful hustler may be mild or rough in manner; he may be physically a giant—very often he is the opposite; he may choose his words with the highest refinement of culture, or he may besprinkle them with coarse expletives. There are scores—nay, hundreds, if not thousands—of successful hustlers, of whom probably not two are exactly alike in disposition or in method. The question then comes, "What constitutes a good hustler?" as the word is ordinarily employed and understood in engineering circles; and though it admits of several answers, possibly the truth will be spoken by saying that the successful hustler is he who gets the best out of the men and materials under his charge.

Piece-work and bonus systems are examples of hustling, and are typical of scores of other systems and methods, the principle underlying them being to constantly attempt to improve on past performances, and thereby get a greater reward; and emphasis needs to be laid on this latter point. Our British employers have one very common failing as compared with their American brethren. The axiom which a large number seem to accept is that a comparatively big wage is not economy; and while they are quite willing that American or any other modern methods should be introduced, they give very little thought to the accompanying factors. A large outlay on a machine-tool is considered both justifiable and commendable if its results bring increased economy of production; but mention a large outlay in salaries, and although the results may be—as they very often actually are—ten or fifty times greater than those from the tool, our engineering principals lose interest. While in many cases the fact that one's reputation as a good hustler does not prejudice an overseer or manager in the eyes of the men, it often happens that he is the object of a great deal of animus.

The successful hustler for a general engineering works must possess more than the average amount of brains, must be strong, both physically and mentally, possessed of indomitable perseverance, able to suit his methods to the class of men he has to deal with, and must have a knowledge of the ultimate requirements of the production he is engaged on and the uses to which it will be put. He should be possessed of great breadth of mind, and should keep himself thoroughly posted up in machine-tool developments and practice, and should possess withal an insatiable desire for an ever-increasing and efficient output.—*Engineering.*

A Derailment Caused by a Pushing Engine.

Lieutenant-Colonel Druitt, reporting to the British Board of Trade, describes the derailment of five cars in a long freight train at Burnley on the Lancashire & Yorkshire, April 20, under circumstances which led him to attribute the accident to a combination of three causes: the stopping of a car at the point of a frog on the outside of a curve; the sudden pushing of that car (when the train was started) by two engines at the rear of the train, and a

very slightly worn condition of the point of the frog. A train consisting of a train engine, 110 loaded wagons, three empty wagons, a brake van and two banking engines, was just starting from the station when the 85th wagon from the front ran off the track. Four others followed it. The train weighed 990 tons, a fact which indicates that all of the wagons were small. The signal man in the cabin nearby at once gave the stop signal and but little damage was done. Colonel Druitt says:

One of the points raised at this inquiry was whether long goods trains, of 100 wagons or more, are more liable to derailments and break-looses than short ones, or whether they are more dangerous to the men employed to work them, or to the traveling public generally, especially on the steep gradients near Burnley. These gradients consist of a length of nearly two miles of 1 in 40 between Accrington and Baxenden, and also of the seven miles of gradients varying from 1 in 65 to 1 in 80 between Burnley and Todmorden, over the Copy Pit summit.

Derailments of wagons at diamond crossings, after the wagons have come to a stand on them, are not of very uncommon occurrence should the wheels of a wagon have got somewhat askew when buffering up on stopping, and such cases are more liable to occur when wagons on starting again are propelled, than when drawn, and especially on curves; but such derailments could happen to short trains equally as to long trains should the gradients over which the train is to run require the use of a banking engine.

There is less danger of run-backs when a train becomes divided on a steep gradient when banking engines are employed, so there is no extra risk of this danger where long trains are employed as they always require banking engines on such gradients, and this reduces the liability to accidents to goods guards, who might suffer severely in the case of a run-back, if in the brake van.

I do not consider there is any extra danger to the men working long trains, though perhaps greater skill and care are required in the manipulation of them, but this has been forthcoming, as I am informed by the company that their records show that accidents have been neither more numerous since the introduction of long trains in 1901, nor do they happen more frequently to long trains than to short ones.

The length of goods trains will be gradually reduced when larger numbers of high capacity wagons become available, but meanwhile the old type of wagons must be continued to be used. A smaller number of wagons though conveying the same tonnage will be more compact and easier to handle. The company claim a great advantage in working traffic, by using one long train in lieu of two short trains on a crowded line with numerous block sections, the saving of time being very considerable.

The principal source of danger to passenger trains from goods trains is probably that in the case of a long train, a wagon off the road might not be noticed by the trainmen as soon as in that of a short train, and the other road on which a passenger train might be passing may be fouled and the danger not noticed so soon; but no accident has happened from this cause so far as I am aware owing to the introduction of long trains, which are now limited to 120 vehicles on the Lancashire and Yorkshire Railway whether loaded or empty.

United States Steel Corporation.

The quarterly statement of this company to June 30 was issued last Tuesday. The amount of orders unfilled on June 30, 4,829,655 tons, though a decrease of 768,105 tons on the same item on March 31, disproves recent rumors of a serious decline in the steel industry.

The net earnings for the half year compare with those of the same period in 1904 and 1903 as follows:

	1905.	1904.	1903.
Second quarter	$30,305,116	$19,490,725	$36,642,308
First quarter	23,025,896	13,445,232	25,068,707
Half year	$53,331,012	$32,935,957	$61,711,015

Interest, sinking funds and other charges amount to $13,429,516, $1,000,000 of this being a special improvement and replacing fund, an item which does not appear in the statement for the first quarter. This leaves $16,875,600 as the balance available for dividends. The quarterly dividend of 1¾ per cent. on the preferred stock amounts to $6,304,919, leaving a surplus of $10,570,681 as compared with $5,873,407 at the end of the first quarter. Of the present surplus, $5,000,000 is appropriated on account of expenditures made and to be made on authorized appropriations for additional property, construction and discharge of capital obligations. The first such appropriation was made on March 31 of this year to the amount of $3,300,000. This quarter there is also $2,500,000 specifically set aside for contemplated appropriations and expenditures. These deductions make the net surplus $3,070,681.

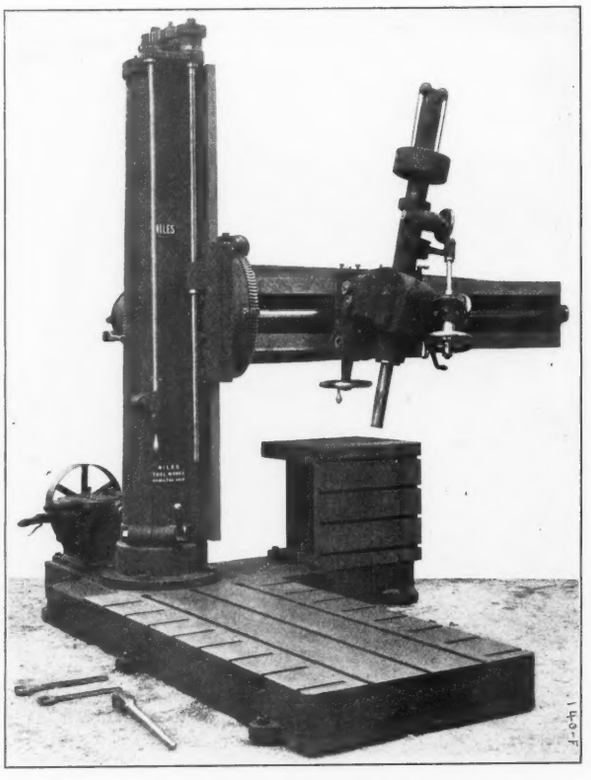
Egyptian Rolling Stock Contracts.

The Egyptian Government lately has awarded contracts for 63 locomotives (15 to be built by Henschel & Co., of Cassel, Germany; 32 by the North British Locomotive Company, of Glasgow, Scotland, and 16 by two factories in France and Belgium); 105 passenger cars to be built by the Metropolitan Railway Car Company, of Birmingham, England; 100 30-ton freight cars by the Leeds Forge Company, England, and 190 10-ton freight and cattle cars by three Belgian car works.—*Consular Report.*

New 6-ft. Niles Universal Radial Drilling Machine.

The accompanying cut shows a radial drill made by the Niles-Bement-Pond Co., New York.

The machine is the result of the experience of the five works of the company in the design and manufacture of radial drills. It is built to use high speed drills to their fullest capacity. The drill head saddle fits between as well as outside of the arm guides, which completes the double box section of the arm and insures great rigidity. The column saddle is strongly gibbed to flat scraped bearings on the column and the post about which the column revolves extends to the extreme top of the sleeve. The use of large shafts, steel



Niles-Bement-Pond New Universal Drilling Machine.

gears, bronze bushings and ring oiling bronze bearings for all fast running shafts makes a strong durable machine capable of standing the hardest service. The principal feature of this machine is its convenience and ease of manipulation. All the feeds and speeds are changed by means of levers, and great care has been taken to arrange the levers and hand wheels, so that they shall be within easy reach of the operator. The column rests on ball bearings.

The machine is adapted for use with either carbon or high speed drills, the range of spindle speeds being sufficient for this purpose. Friction clutches are used for starting and stopping the machine at high speeds, so as to prevent shock and consequent wear. The speed box is planed on the top, in order that the drill may be easily changed from a belt-driven machine to a motor-driven machine, by the simple substitution of two gears for the pulley. Reversing gears for tapping are provided and all speeds and feeds may be changed while the machine is running even at its highest speeds.

This radial drill is a full universal machine, that is, both the arm and the saddle swivel. The principal dimensions of the machine are as follows:

Drills to the center of	12 ft.
Max. distance from face of column to center of drill	77½ in.
Least distance from face of column to center of drill	22½ "
Greatest distance from spindle to base plate	72 "
Traverse of spindle	20 "

Georgia Peaches.

The peach shipments from the Augusta district this year will far surpass those of any other season. Within the twenty-four hours ending at noon yesterday the Georgia Railroad received and forwarded 165 cars of Elbertas, after icing the cars at the local refrigerators. This is the biggest day's record, though the season is now at its height, and will last about one week longer, during which the road and ice manufactories will be hard put to keep up with the supply from the orchards. Within 24 hours there had to be put

aboard the cars 825 tons of ice properly placed, with the concomitant shifting and regulating. Along every mile between Augusta and Macon the orchards extend in almost one unbroken line, there being a million and a half trees in bearing this year, an increase of 300 per cent. over last season—figures that mark this as one of the finest peach growing districts in the world. The fruit comes to its maturity midway in time between the South Georgia orchards and those above Atlanta, comprised in what is known as the North Georgia crop. One hundred and sixty-five cars, with an average of 500 crates to the car means 82,500 crates, or 495,000 baskets, or about 11,800,000 peaches concealed in their wooden casings, waiting in the cool depths of the cars to scatter their blessing to the ends of the United States. If these 11,800,000 peaches were placed end to end they would reach 567 miles; or from Augusta to Washington; one long connecting link of ruddy hued, crimson-cheeked lusciousness to which the ambrosia of the gods is as breakfast food to the epicure.—*Augusta (Ga.) Chronicle, July* 21.

Motor Omnibuses in England.

The increase in the number of motor buses for passenger traffic in London and other towns and cities of the United Kingdom has been very marked. The price of the standard double-deck omnibus, carrying 36 passengers, is $4,623 net London; of the single-deck type, carrying 18 passengers, $4,136 net London. The cost of running vehicles of this type, inclusive of all management expenses, depreciation, drivers and conductors' wages, petrol, etc., works out at about 21 cents per mile, while the average receipts of the various companies who have them in use is about 33 cents per mile. According to the London *Daily Mail* of May 26, 1905, the London motor omnibuses, all last spring succeeded beyond the most sanguine expectations of the companies and individuals running them.—*Consular Report.*

New York Surface Lines.

The earnings of the New York City Railway in June aggregated $1,887,834, as compared with $1,865,065 in June, 1904, and $1,764,798 in June, 1903. Thus there is an increase in two years of almost $125,000 a month (as indicated by the June figures) in spite of the competition of the subway. As a matter of fact, the surface lines have felt the subway competition quite sharply but in the hot weather the subway was slightly less popular than it was in the colder months. It will be recollected that the company's statement for the three months ending March 31, 1905, which was the first statement covering a full quarter's operation of the system in competition with the subway, showed gross earnings of only $3,639,468, a considerable decrease from the year previous. This March showing, however, reflected not only the competition of the subway, but also the result of an exceptionally severe winter, with much snow.

Establishment of a Canals Trust in Great Britain.

A recent bill enacted by Parliament establishes a strong central canals trust for the purpose, in the first instance, of taking over, improving and managing certain specified canals which form a chain of navigation between the principal ports in England. Powers are also taken for subsequently acquiring other canals, but not the Manchester Ship Canal, and for the improvement and management of these other canals. The purpose of the bill is by this consolidation of interests and management to improve the facilities for water carriage and to establish a complete system of intercommunication. The bill was first presented last winter and has now been amended in some slight particulars and appears under date of July 4, 1905. The canals trust is a body corporate composed of thirty-seven trustees, of which seven are appointed by the Treasury, seven by the Board of Trade, seven by the Board of Agriculture and Fisheries and two each by the port authorities of the principal seaports and by other associations. It is provided that no officer of a railroad company shall be eligible for the office of trustee. The trust is required as soon as possible to take steps to acquire the Birmingham, Coventry, Grand Junction, Leeds & Liverpool, Oxford, Staffordshire & Worcestershire, Warwick & Birmingham, and Warwick & Napton canals; also to undertake the Kennet & Avon canal navigation and the River Avon navigation (now managed by the Great Western Railway), the Sharpness New Docks and Gloucester & Birmingham Navigation Co., the Trent Navigation Co. and the navigation of the rivers Aire and Calder. After this has been done the trust may acquire further canal companies, apparently, at its own discretion. The provision for recompense is simply that the trust shall pay to each company such sums as may be mutually agreed upon; or in default of agreement the trust may obtain a provisional order authorizing the acquisition of the canal and a court of arbitration, provided for by the Act, may appraise the property. In determining the sum to be paid to each company in case of arbitration, it is provided that the court shall take into account the manner in which the canal has been maintained and administered; also whether reasonable efforts have been made to encourage traffic on it and whether any substantial and permanent increase in the value of the canal property, other than the part acquired by the trust, is shown to be probable by reason of this acquisition by the trust. The court of arbitration consists of three arbitrators, one to be appointed by the Lower Chief Justice of England, one by the Treasury and one by the President of the Board of Trade.

It is provided that a canal fund shall be established and all receipts of the trust shall be carried to that fund and all payments by the trust shall be made out of that fund. Any holder of securities shall have the same rights and remedies, as nearly as may be, against the trust and the canal fund as he would have had against the company. The trust is authorized to borrow money for the purpose of taking over the canal properties, for redeeming funded obligations and for completing new work which had been authorized by the canal companies, by Act of Parliament, before the passage of the Canals Act. To accomplish this the trust is authorized to create an issue of guaranteed canal stock bearing interest at a rate not to exceed 3¼ per cent. and this stock is to be charged on the canal fund and on all the revenues of the trust, with its interest guaranteed by the Treasury. It is provided that the trust shall carry a large reserve fund as fast as it can accumulate it and that current income after payment of current expenses, maintenance and fixed charges may be applied at the discretion of the trust under certain restrictions. It is specifically provided that the trust shall not itself undertake the business of a carrier of traffic on any of the canals acquired by it, but shall be in the nature of a holding company, as its name implies. The Act does not apply to Scotland and Ireland and the Manchester Ship Canal is specifically excepted from its rulings.

Manufacturing and Business.

A contract has been given to A. S. Schulman, of Cincinnati, at $90,000, for the electrical equipment of the new union station at Washington, D. C.

Announcement is made by Geo. M. Kenyon, of St. Paul, Minn., dealer in railroad supplies, that on August 1 he will remove to 600-601 Pioneer Press Building, St. Paul, Minn.

On July 24, according to reports from Guayaquil, Ecuador, the Guayaquil-Quito Railway Co. opened its line to Riobamba, which is the capital of the province of Chimborazo and 9,064 ft. above sea level.

Mr. E. M. Woodward has been elected President and Treasurer, Mr. A. M. Powell, Vice-President and Superintendent, and Mr. J. W. Robinson, Secretary, of the Woodward & Powell Planer Co., of Worcester, Mass.

The Pond Engineering & Contracting Co. has been incorporated in New York with a capital of $25,000 to conduct an engineering and contracting business by N. H. Nieman and R. H. Waddell, of New York, and A. A. Kelly, of Montclair, N. J.

Plans and specifications are on file with the Chilean Legation in Washington, D. C., and with the Consulate General, 135 West 11th street, New York City, for building docks and making improvements in the harbor of Valparaiso, at an aggregate cost of about $12,500,000. Bids are asked for this work by or before April 2, 1906.

Mr. William Jessop, chairman of William Jessop & Sons, Limited, steel manufacturers, of Sheffield, England, and president of the Jessop Steel Company, of Washington, Pa., died on July 4 at his country estate at Bradfield, England. He was the head of the fourth generation of the Jessop family in control of the firm. In 1903 he visited America.

Plans and specifications are on file with the Cuban Consul-General at 96 Wall street, New York, for the construction of a wharf, custom-house and appraiser's office in Havana harbor at an aggregate cost of about $3,000,000. Bids will be received in Havana for this work up to November 9. The government will also grant a 99-year concession for wharf rights and privileges.

Mr. Arthur Koppel announces, in connection with the notice published in our issue of July 14 that Mr. Ernst Wiener, formerly his manager, had severed his connection with Mr. Koppel, that Mr. Carl Koch was not his chief engineer, but was only one of many engineers. Also that the statement that Mr. Wiener has associated with him a large part of Mr. Koppel's former staff is exaggerated, as only five of Mr. Koppel's force left with Mr. Wiener.

The report of the United States Engineer, Lieut-Col. Charles E. L. B. Davis, in charge of the deep waterway between Duluth, Chicago and Buffalo, recently made public, recommends an appropriation of $3,393,000 to be spent on the St. Mary's Falls canal at Sault Ste. Marie. Of this sum, $3,300,000 is for the proposed new lock. One million dollars is asked for the completion of the Hay Lake and Neebish channels, the amount on hand being $2,146,428; the balance of $93,797 is to be used on improvements in the St. Mary's river. Lieut.-Col. Davis estimates that the maximum cost of building a 21-ft. channel from Lake Superior to Lake Huron would be $10,160,000, and to secure a uniform depth of 21 ft. in the Detroit river would involve an outlay of $2,000,000.

Iron and Steel.

The New York Central Lines, it is said, have given an additional order for 25,000 tons of rails.

The steamer Colon, which recently sailed from Baltimore, carried a cargo of steel rails and fish plates to be used in double tracking the Panama Railroad.

The American Rolling Mill Co., of Middletown, Ohio, has bought the property of the Muskingum Valley Steel Co., at Zanesville, and will now be able to make 35,000 tons of ingots and 30,000 tons of black and galvanized sheets yearly. George M. Verity, of Middletown, Ohio, is president and treasurer, and R. C. Phillips, of the same place, secretary.

Orders for rails recently placed aggregate about 75,000 tons. The Missouri Pacific and allied companies have ordered 30,000 tons, mainly from the Carnegie Steel Co., which also has an order for 10,000 tons for the Mexican Central and part of an order of 12,000 tons for the Kansas City Southern which the Republic Iron & Steel Co., it is said, cannot supply. An order has been given by a northwestern road for 17,000 tons of standard sections to an eastern independent mill. Negotiations are pending for about 50,000 tons for domestic use and approximately 8,000 tons for export. The Manhattan bridge specifications, which are now being advertised, call for about 50,000 tons of structural steel, which will be ordered during the coming month.

PERSONAL.

—Mr. Ira O. Rhoades, who has been appointed General Purchasing Agent of the Southern Pacific, with headquarters at San Francisco, was born in 1863 at Rockland, Maine, and was educated in the public schools of Omaha, Nebraska. He began his railroad service with the Union Pacific in 1880, as messenger and office boy in the stores department. During the next eight years he was receiving and shipping clerk, foreman, tie inspector and chief clerk to the General Storekeeper. On September 1, 1888, he was made chief clerk to the General Purchasing Agent and held that position until March, 1897, when he went to the Oregon Short Line as General Purchasing Agent, with headquarters at Salt Lake City, Utah, where he remained until he was appointed to his present position on June 15 of this year.

Ira O. Rhoades.

—Mr. G. W. Vaughan, who has been appointed Engineer of Maintenance of Way, of the New York Central, was born in 1859. After a course at Warren Polytechnic College he entered railroad service in 1881 as a rodman on the Pittsburg, Cincinnati & St. Louis. From April, 1883, to April, 1884, he was Assistant to the Engineer of Maintenance of Way; from April, 1884, to March, 1887, Supervisor of Track on the third sub-division, and to April, 1887, Assistant Engineer of Maintenance of Way. He then went to the New York, Chicago & St. Louis, where he was Assistant to the Division Engineer of the Eastern division until February, 1889, when he became Division Engineer of the same division. From March, 1894, to August, 1898, he was Engineer of Maintenance of Way and from August, 1898, to November, 1899, Engineer in charge of reconstruction and of maintenance of bridges and buildings. In December, 1899, he went to the New York Central as Supervisor of Bridges and Buildings on the Eastern division. In December, 1900, he was appointed Division Engineer of the Pennsylvania division, and in September, 1901, Division Engineer of the Western division, which position he held until July 1st of the present year.

G. W. Vaughan.

—Mr. Lyman Erastus Roys died on July 12 at Rutland, Vt., at the age of 77. Mr. Roys entered the employ of the Central Vermont at the age of eighteen. In 1865 he was appointed Civil Engineer and Superintendent of Buildings, and when the New London Northern was acquired he held the same position on that road. He surveyed and built the Addison Railroad, running from Leslie Junction to Ticonderoga, N. Y.

—Mr. R. D. Hawkins, who has been appointed General Master Mechanic of the Central district of the Great Northern, is a graduate of the mechanical engineering course of Purdue University. He remained at Purdue as instructor a year after graduation, and then went to New Orleans, where he installed an iron foundry and woodworking shops. Later he served as a machinist in the Buchel Machine Works in that city. In 1898, he opened an office in Indianapolis as Consulting Engineer and the next year went to the Great Northern.

—Mr. Daniel S. Lamont, former Secretary of War and Vice President of the Northern Pacific, died suddenly at his home in Millbrook, N. Y., on July 23. Mr. Lamont was born in 1852 and graduated from Union College in 1872. In 1896, after serving as Secretary of War under President Cleveland, he became Vice President of the Northern Pacific, in charge of its eastern affairs, and was prominent in the reorganization of the road. He was a director of the Northern Pacific, the Northern Securities Company, the St. Paul & Northern Pacific, the International, the Manitoba and the Syracuse, Binghamton & New York; and a trustee of the Washington & Columbia River.

ELECTIONS AND APPOINTMENTS.

Arkansas Southern.—M. A. Hansen, Engineer of River Protection on the Missouri Pacific, has been appointed Chief Engineer, with headquarters at Ruston, La.

Augusta & Florida.—The following officers have been elected: Allen W. Jones, President; W. M. Blunt, Vice-President and General Manager; H. S. Jones, Secretary.

Chicago Great Western.—F. A. Peterson has been appointed Division Engineer of the Southwest division, succeeding C. G. Delo.

Chicago, Rock Island & Pacific.—The position of Assistant to the General Manager, heretofore held by W. G. Bierd, has been abolished, and Mr. Bierd has been appointed Superintendent of Terminals at Chicago, succeeding C. H. Hubbell.

Detroit, Toledo & Ironton.—F. A. Durban has been elected President and Benjamin S. Warren, Vice-President. H. Scott has been elected a director. C. P. Lamprey has been appointed General Traffic Manager of this road and of the Ann Arbor, with headquarters at Toledo, Ohio. John J. Kirby, General Passenger Agent of the Ann Arbor, has been appointed General Passenger Agent of the two roads, with headquarters at Toledo. The office of General Freight Agent of the Ann Arbor has been abolished, C. H. Bell, Chief Clerk to the General Freight and Passenger Agent, has been appointed Assistant General Freight Agent of both roads.

Erie.—W. H. Peddle, Superintendent of Terminals with authority over the stations at New York City, Jersey City, Weehawken, Bergen and the Pavonia Ferry, has resigned, effective August 1. J. M. Barrett, Superintendent of the Chicago & Erie division, will succeed Mr. Peddle.

The authority of George Van Keuren, General Superintendent, has been extended over the New York station and the Jersey City properties.

Great Northern.—Howard James, Purchasing Agent, has been appointed Assistant to the President, with headquarters at Seattle, Wash., and also President and General Manager of the Great Northern Steamship Company, with headquarters at Seattle, Wash., succeeding in both positions J. D. Farrell, resigned.

Lake Erie & Western.—G. P. Smith, Engineer of Maintenance of Way of the Indiana, Illinois & Iowa, has been appointed Chief Engineer of the Lake Erie & Western and of the Indiana, Illinois & Iowa, with headquarters at Indianapolis, Ind., succeeding E. A. Handy.

The office of Wilmer Mitten, Master Mechanic, has been moved from Fort Wayne to Muncie, Ind. I. W. Kurtz, Master Mechanic at Peru, Ind., has resigned, effective August 1. He will be succeeded by C. H. Mashey.

Lake Shore & Michigan Southern.—F. E. Woodruff, Chief Clerk to the General Manager, has been appointed to the new position of Inspector of Passenger Trains and Station Service. Charles Donahue, Chief Clerk to the Superintendent of Motive Power, succeeds Mr. Woodruff.

Lehigh Valley.—J. F. Schaperkotter has been appointed General Solicitor, with headquarters at New York, succeeding H. S. Drinker.

J. W. Platten, Assistant to the President, has resigned, effective September 1. E. A. Albright, Assistant Secretary, succeeds Mr. Platten, with headquarters at Philadelphia. The General Auditor, Treasurer and Secretary will report to the Assistant to the President. L. D. Smith has been elected Assistant Secretary, with headquarters at New York, succeeding Mr. Albright.

Louisville & Nashville.—Commencing August 1, the Alabama Mineral Division will be operated as a part of the Birmingham Mineral Division, with T. E. Brooks, Superintendent; office at Birmingham. The office of Superintendent at Anniston will be discontinued, W. E. Knox having been assigned to other duties.

Macon & Birmingham.—S. F. Parrott, recently elected Vice-President and General Manager of the Georgia Southern & Florida, has been appointed Acting Vice-President of this road, succeeding W. C. Shaw, resigned.

Missouri Pacific.—F. B. Scheetz, Assistant Engineer at St. Louis, has been appointed Engineer of Bridges and Buildings of this road and of the St. Louis, Iron Mountain & Southern, with headquarters at St. Louis, succeeding E. Fisher.

Herbert Murphy has been appointed Division Engineer at Kansas City, in charge of the construction of new yards.

New York Central & Hudson River.—H. Fernstrom, Chief Engineer, has resigned. Until further notice, all maintenance and construction work and organizations engaged therein, except as otherwise arranged, will be under the authority of Charles Parker, Principal Assistant Engineer.

New York State Railroad Commission.—Frederick E. Gunnison has been appointed commissioner, completing the board of five as provided for by the new law. The other members are: Joseph M. Dickey, G. G. Dunn, Frank M. Baker and George W. Aldridge.

Oregon Railway & Navigation.—Andrew Maclean, Constructing Engineer of the Colorado Fuel & Iron Co., has been appointed Chief Electrician and Constructing Engineer, with headquarters at Portland, Ore.

Panama Canal.—Jackson Smith, Assistant to the First Vice-President of the National of Mexico, has been appointed one of the Assistant Engineers of Construction.

Pennsylvania.—Elliott Sumner, Assistant Engineer of Motive Power at Jersey City, has been appointed Engineer of Motive Power of the United Railroads of New Jersey division. H. P. Meredith, Assistant Master Mechanic at Altoona, has been appointed Assistant Engineer of Motive Power at Jersey City, succeeding Mr. Sumner. M. J. Davis, Inspector at Altoona, and P. L. Grove, Foreman of the Bedford, Pa., shops, have been appointed Assistant Master Mechanics, succeeding Mr. Meredith.

Pere Marquette.—The authority of J. S. Pyeatt, Superintendent of the Buffalo division, has been extended to Grand Rapids. His headquarters will be at Detroit.

Pullman Company.—F. N. Bostwick, Assistant Superintendent of the Southeastern division, has been appointed Assistant General Manager with headquarters in Chicago, effective August 1. John T. Ranson, Chief Clerk, will succeed Mr. Bostwick.

Rio Grande.—August Celaya has been elected President; Joseph Celaya, Treasurer; and William A. Neale, Secretary. The following directors have been elected: Joseph Celaya, August Celaya, James B. Wells, George L. Edwards, Edward C. Eliott, Thomas W. Carter and Duval West.

St. Louis, Iron Mountain & Southern.—See Missouri Pacific.

St. Louis Southwestern.—T. E. Adams, General Master Mechanic, has been appointed Superintendent of Motive Power, the office of General Master Mechanic having been abolished.

San Pedro, Los Angeles & Salt Lake.—H. B. Worden, Assistant General Freight Agent, has resigned.

Seaboard Air Line.—R. I. Cheatham, Assistant General Freight Agent, has resigned. J. A. Pride, Commercial Agent at Columbia, S. C., has been appointed Assistant General Freight Agent, succeeding Mr. Cheatham.

Union Pacific.—Ernest Stenger, Assistant Superintendent of the Wyoming division, has been appointed Superintendent of the Colorado division, with headquarters at Denver, Colo., succeeding H. C. Ferris, resigned. H. L. Anderson, Trainmaster at Green River, Wyo., has been appointed Assistant Superintendent of the Wyoming division, with headquarters at Cheyenne, Wyo., succeeding Mr. Stenger.

Webb C. Ball has been appointed General Time Inspector, succeeding J. W. Forsinger.

Virginia & Truckee Railway.—The following officers and directors of this company, which is the successor to the Virginia & Truckee Railroad, have been elected: D. O. Mills, President; H. M. Yerington, General Manager; E. B. Yerington, Secretary; and W. E. F. Beal, A. M. Ardery, James Newlands, Jr., W. E. Sharon and J. W. Eckley, directors.

Wabash.—John Lange, Master Car Builder at Moberly, Mo., has resigned. Mr. Lange is 77 years old and resigns because of ill health.

Steven E. Cotter, Superintendent of the Middle division, has been appointed General Superintendent, with headquarters at St. Louis, succeeding H. L. Magee, resigned on account of sickness.

LOCOMOTIVE BUILDING.

The Wabash has ordered 15 consolidation locomotives from the Baldwin Works.

The Chicago Junction has ordered two mogul locomotives from the American Locomotive Co.

The New York Central & Hudson River is building a four-cylinder balanced inspection locomotive.

The Chicago, Peoria & St. Louis has ordered two simple six-wheel (0-6-0) switching and two consolidation (2-8-0) locomotives from the Rogers works of the American Locomotive Co., for September delivery. The switching locomotives will weigh 133,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 50 in.; straight boiler, with a working steam pressure of 180 lbs.; heating surface, 1,840 sq. ft.; 280 National tubes, 2 in. in diameter and 11 ft. 6 in. long; Otis steel firebox, 102 in. x 40½ in.; grate area, 29 sq. ft.; tank capacity, 4,000 gallons, and coal capacity, 6 tons. The consolidation locomotives will weigh 165,000 lbs., with 145,000 lbs. on drivers; cylinders, 20 in. x 26 in.; diameter of drivers, 54 in.; straight boiler, with a working steam pressure of 200 lbs.; heating surface, 2,245 sq. ft.; 288 tubes, 2 in. in diameter and 13 ft. 10 in. long; firebox, 116 in. x 40⅜ in.; grate area, 32½ sq. ft.; tank capacity, 6,000 gallons, and coal capacity, 10 tons. The special equipment for all includes: Westinghouse air-brakes, Cambria axles, Magnesia boiler lagging and metal brake-beams for switching locomotives, steel back brake-shoes, Tower couplers for switching locomotives and Kelso couplers for consolidation locomotives, Dressel headlights, Ohio injectors, Jerome piston and valve rod packings, Hayden safety valves, Leach sanding devices, Nathan triple sight-feed lubricators for switching locomotives, Scott springs, Ashcroft steam gages, Midvale driving wheel tires for switching locomotives, cast-steel tender wheel tires and wheel centers, and Richardson valves for consolidation locomotives.

CAR BUILDING.

The Canadian Pacific is building 19 sleeping cars and nine tourist cars.

The Chicago & North-Western has recently ordered nine passenger cars from the Pullman Co.

The Cuba Company has ordered from the Middletown Car Works 300 platform cars with King patent steel underframes.

The Central Northern of Argentina has ordered from the Middletown Car Works 40 platform cars fitted with King patent steel underframes.

The Harriman Lines have ordered 2,550 steel-underframe box cars of 100,000 lbs. capacity and 400 steel-underframe stock cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Chicago, Rock Island & Pacific has ordered two combination parlor and coach cars, four combination dining and passenger cars and two dining cars from the Pullman Co., and 56 combination smoking and baggage cars, 10 passenger cars, 10 chair cars and 10 baggage cars from the American Car & Foundry Co.

The Norfolk & Western has ordered 500 drop bottom gondolas of 100,000 lbs. capacity from the Pittsburg works of the Pressed Steel Car Co. These cars will be built according to the specifications of the sample car built recently by the Norfolk & Western in its Roanoke shops. They will have steel underframes and will weigh 38,000 lbs. each.

The St. Louis & San Francisco has ordered 400 National coal dump cars of 80,000 lbs. capacity, 500 hopper coal cars of 100,000 lbs. capacity, 500 coal cars of 100,000 lbs. capacity, six postal cars and 10 combination baggage and mail cars from the American Car & Foundry Co. and 100 coal dump cars of 100,000 lbs. capacity from the Pressed Steel Car Co. The National coal dump cars will be 34 ft. 8 in. long, 9 ft. 7 in. wide and 4 ft. 2 in. high, inside measurements, and 36 ft. 4 in. long, 10 ft. wide and 9 ft. 1 in. high over all, with wooden frames and steel underframes. The special equipment includes: Simplex bolsters, Hewitt brasses, and Miner draft rigging. The hopper coal cars will be 33 ft. 9 in. long, 8 ft. 9½ in. wide and 7 ft. 11 in. high, inside measurements, and 36 ft. 1 in. long, 9 ft. 6 in. wide and 10 ft. 6 in. high over all, with wooden

frames and steel underframes. The special equipment includes: Simplex brake-beams, Ajax brasses, Miner draft rigging and McCord journal boxes. The coal cars will weigh 39,200 lbs. and will be 40 ft. long, 9 ft. 3½ in. wide and 4 ft. high, inside measurements, and 41 ft. 6 in. long, 10 ft. 2½ in. wide and 8 ft. 11¼ in. high over all. The special equipment includes: Simplex brake-beams, Ajax brasses, Miner draft rigging and McCord journal boxes. The coal dump cars will be 40 ft. long, 9 ft. 3 in. wide and 4 ft. 3⅜ in. high, inside measurements, and 41 ft. ½ in. long, 10 ft. 2 in. wide and 8 ft. 10 in. high over all, with steel frames and underframes. The special equipment includes: Hewitt brasses, Miner draft rigging and McCord journal boxes. All these cars will have Chicago couplers. The baggage and mail cars will be 69 ft. 2 in. long and 9 ft. 1¾ in. wide, inside measurements, and 73 ft. 2 in. long and 10 ft. wide over all, with wooden frames and underframes. The postal cars will be 60 ft. long and 9 ft. wide, inside measurements, and 63 ft. 11 in. long and 10 ft. wide over all. The special equipment for both the baggage and mail cars and the postal cars includes: Diamond special brake-beams, Streeter brake-shoes, Hewitt brasses, Janney couplers, Westinghouse friction draft rigging, New York safety heating system, Pintsch light, Lawler platforms and Pullman vestibules.

BRIDGE BUILDING.

Alviston, Ont.—Bids are being asked by R. S. Code, County Engineer, for putting up a steel bridge over the Sydenham river.

Ashland, Ky.—The Cincinnati, Hamilton & Dayton is locating the site to build its proposed bridge over the Ohio river.

Benton, Me.—A contract has been given to the New England Construction Co., of East Everett, Mass., at $10,450 for building a bridge 255 ft. long over the Sebasticook river.

Bridgeport, Conn.—Bids are wanted, August 10, by E. T. Buckingham, City Clerk, for building a reinforced concrete arch over Ash creek, between Bridgeport and Fairfield.

Chillicothe, Ohio.—Bids will soon be asked by the County Commissioners for repairs to the present structure at Bainbridge and for building two steel bridges each 200 ft. long, one at Vigo and one at Austin. B. H. Walker is County Surveyor.

Clarksdale, Miss.—Bids are wanted, August 7, by the Board of Supervisors of Coahoma County, for building a steel bridge over the Sunflower river. A. M. Searles, Vicksburg, Miss., is engineer in charge.

Fairmont, W. Va.—A contract has been given by the Baltimore & Ohio to F. H. Clements & Co., of Philadelphia, for the stone work on the bridge which it is building over the Monongahela river at Hoult. The bridge, which is to replace the present structure, will cost, when completed, nearly $400,000.

Kansas City, Mo.—The Chicago, Rock Island & Pacific has under consideration the question of building a steel bridge over the Kaw river at Kansas avenue in Armourdale, plans for which have been approved by the War Department.

Manitowoc, Wis.—Plans have been submitted by City Surveyor Unger to the City Council for two kinds of bridges, one for a swing bridge to cost about $70,000 and the other for a bascule bridge to cost $100,000, to be built over the river at Main street.

Mt. Clemens, Mich.—Bids, it is said, are wanted, August 7, by William F. Kracht, City Clerk, for putting up a two-span reinforced concrete bridge with a total length of 195 ft. and a roadway 50 ft. wide.

New Albany, Ind.—The Board of County Commissioners will give a contract on August 7 for building two stone abutments and an iron bridge over Little Indian creek at Wheeler's Ford, in Lafayette township; also for the abutments and bridge to be built at Burkhardt's mill, in Georgetown township.

New York, N. Y.—Bids are wanted, August 10, by Commissioner of Bridges George E. Best for the metal work for the superstructure, the anchorages, towers, etc., of the Manhattan bridge, to be built over the East river between the boroughs of Manhattan and Brooklyn.

Redding, Cal.—The Supervisors of Shasta County will soon ask for bids for putting up a steel bridge 150 ft. long over Cow creek. R. L. Reading is County Surveyor.

Richmond, Va.—The Joint Bridge Committee, at a recent meeting has decided in favor of a bridge to cost $100,000, to be built over the James river, between this place and Manchester.

Sacramento, Cal.—Plans, it is said, have been ordered to be made by the Board of Supervisors for a concrete bridge over Buffalo creek to cost about $30,000.

St. Johns, N. B.—Bids are wanted by G. S. King and George McAvity, commissioners for the New Brunswick Coal & Railway Co., for putting up a number of bridges between Norton and Chipman.

Wilkesbarre, Pa.—The Delaware & Hudson and the Jersey Central, it is said, have agreed to jointly build a bridge over the tracks between the east end and North Wilkesbarre.

Other Structures.

Allegheny, Pa.—Roydhouse, Arey & Co. have the contract for building the new Pennsylvania station. Work is to be commenced next month.

Americus, Ga.—The Central of Georgia is planning to put up a new passenger station here.

Chicago, Ill.—Bids will be asked next month by Frost & Granger, architects, for building a one-story stone station, 40 ft. x 115 ft., at 47th street, for the Chicago & Western Indiana, to cost about $30,000. Work is to be commenced as soon as bids are received and examined. Bids will also be asked about the same time for putting up a one-story station at 55th street, 30 ft. x 70 ft., to cost about $20,000. E. H. Lee is chief engineer of the road.

Louisville, Ky.—The union passenger station was destroyed by fire on July 17; loss about $300,000.

Mahanoy City, Pa.—The Philadelphia & Reading will soon begin putting up a stone passenger station to cost $15,000.

Philadelphia, Pa.—The Philadelphia Rapid Transit Co. is building a large underground station, 375 ft. long, on both sides of Market street between 15th and 17th streets.

Pine Bluff, Ark.—An ordinance has been introduced in the City Council to grant the St. Louis, Iron Mountain & Southern a 50-year franchise and permission to build a new station and make other improvements.

Pittsburg, Pa.—The Wabash is building a large fireproof freight station here.

Sapulpa, Ind. T.—The St. Louis & San Francisco improvements to be made here at a cost of about $40,000, include a new passenger station and an addition to the roundhouse.

Valdosta, Ga.—The Georgia Southern, it is said, has plans ready for putting up a brick passenger station to cost $20,000.

Wilmington, Del.—The Philadelphia, Baltimore & Washington has given a contract to Roydhouse, Arey & Co., for putting up its office building, to cost about $175,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Apalachicola & Northern.—A contract has been given by this company to the Morey Engineering Company, of St. Louis, for building its proposed railroad from Apalachicola to Quincy, Florida, a distance of about 80 miles. (April 14, p. 121.)

Atlantic, Quebec & Western.—This company, which has been granted a charter by the Dominion Government, also a subsidy of $6,400 a mile, and a grant of 4,000 acres of land per mile by the Province of Quebec, is making plans to build its proposed road from Gaspe Village, southwest to Causapcal on the Intercolonial, a distance of about 170 miles. The road is designed to make connection with a fast line of steamers, to avoid the dangers of the St. Lawrence river and to gain 24 hours over the present route from Montreal. The same company will build along the Gaspe coast, south, for a distance of 100 miles, to a connection with the Atlantic & Lake Superior.

Baltimore & Ohio.—A contract has been given by this company to Thomas A. Shoemaker & Co., of Pittsburg, Pa., for building about three miles of new track on the main line from Hollofields to Alberton, a short distance west of Ellicott City, Md. This is a continuance of the work which has been carried on for several years in straightening the alinement and making a low grade freight line from Relay to Washington Junction, upon which over $2,000,000 has already been spent. The new improvements on which the contractors will begin work at once will cost between $600,000 and $700,000.

Cairo & Tennessee.—Surveys have been completed by this company for building a railroad from Bristol, Tenn., west through Hawkins, Hancock, Claiborne and Campbell counties in Tennessee, and Whitley, Wayne, Clinton, Cumberland, Monroe, Allen, Simpson, Logan, Todd, Christian, Trigg, Calloway, Marshall, Graves, Carlisle and Ballard counties in Kentucky, a distance of about 400 miles. The company is negotiating with a New York trust company for a loan of $12,500,000. Construction work is expected to commence in a short time. New York and Kentucky capitalists are backing the project.

California & Northeastern.—A charter has been granted this company in California with a capital of $5,400,000 to build a railroad from the Southern Pacific at Weed, in Siskiyou County, Cal., north to Klamath Falls, in Oregon, with branches to Rhett Lake and the

Lake of the Woods. The main line will be 100 miles long and the branch 70 miles. The directors are A. H. Naftzger, G. X. Wendling, H. Naething, C. M. Cross and G. E. Bettinger.

CANADIAN PACIFIC.—Work, it is said, will be commenced at once by the contractors, Foley Bros., on double tracking the main line of this road from Fort William to Winnipeg, a distance of about 426 miles. The estimated time for the completion of this work is three years.

This company, it is said, will at once begin work on two lines in Northern Manitoba along the west shore of Lake Winnipeg. One will extend to Gimli and the other to Icelandic river.

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BRIDGE BUILDING.

Alviston, Ont.—Bids are being asked by R. S. Code, County Engineer, for putting up a steel bridge over the Sydenham river.

Ashland, Ky.—The Cincinnati, Hamilton & Dayton is locating the site to build its proposed bridge over the Ohio river.

Benton, Me.—A contract has been given to the New England Construction Co., of East Everett, Mass., at $10,450 for building a bridge 255 ft. long over the Sebasticook river.

Bridgeport, Conn.—Bids are wanted, August 10, by E. T. Buckingham, City Clerk, for building a reinforced concrete arch over Ash creek, between Bridgeport and Fairfield.

Chillicothe, Ohio.—Bids will soon be asked by the County Commissioners for repairs to the present structure at Bainbridge and for building two steel bridges each 200 ft. long, one at Vigo and one at Austin. B. H. Walker is County Surveyor.

Clarksdale, Miss.—Bids are wanted, August 7, by the Board of Supervisors of Coahoma County, for building a steel bridge over the Sunflower river. A. M. Searles, Vicksburg, Miss., is engineer in charge.

Fairmont, W. Va.—A contract has been given by the Baltimore & Ohio to F. H. Clements & Co., of Philadelphia, for the stone work on the bridge which it is building over the Monongahela river at Hoult. The bridge, which is to replace the present structure, will cost, when completed, nearly $400,000.

Kansas City, Mo.—The Chicago, Rock Island & Pacific has under consideration the question of building a steel bridge over the Kaw river at Kansas avenue in Armourdale, plans for which have been approved by the War Department.

Manitowoc, Wis.—Plans have been submitted by City Surveyor Unger to the City Council for two kinds of bridges, one for a swing bridge to cost about $70,000 and the other for a bascule bridge to cost $100,000, to be built over the river at Main street.

Mt. Clemens, Mich.—Bids, it is said, are wanted, August 7, by William F. Kracht, City Clerk, for putting up a two-span reinforced concrete bridge with a total length of 195 ft. and a roadway 50 ft. wide.

New Albany, Ind.—The Board of County Commissioners will give a contract on August 7 for building two stone abutments and an iron bridge over Little Indian creek at Wheeler's Ford, in Lafayette township; also for the abutments and bridge to be built at Burkhardt's mill, in Georgetown township.

New York, N. Y.—Bids are wanted, August 10, by Commissioner of Bridges George E. Best for the metal work for the superstructure, the anchorages, towers, etc., of the Manhattan bridge, to be built over the East river between the boroughs of Manhattan and Brooklyn.

Redding, Cal.—The Supervisors of Shasta County will soon ask for bids for putting up a steel bridge 150 ft. long over Cow creek. R. L. Reading is County Surveyor.

Richmond, Va.—The Joint Bridge Committee, at a recent meeting has decided in favor of a bridge to cost $100,000, to be built over the James river, between this place and Manchester.

Sacramento, Cal.—Plans, it is said, have been ordered to be made by the Board of Supervisors for a concrete bridge over Buffalo creek to cost about $30,000.

St. Johns, N. B.—Bids are wanted by G. S. King and George McAvity, commissioners for the New Brunswick Coal & Railway Co., for putting up a number of bridges between Norton and Chipman.

Wilkesbarre, Pa.—The Delaware & Hudson and the Jersey Central, it is said, have agreed to jointly build a bridge over the tracks between the east end and North Wilkesbarre.

Other Structures.

Allegheny, Pa.—Roydhouse, Arey & Co. have the contract for building the new Pennsylvania station. Work is to be commenced next month.

Americus, Ga.—The Central of Georgia is planning to put up a new passenger station here.

Chicago, Ill.—Bids will be asked next month by Frost & Granger, architects, for building a one-story stone station, 40 ft. x 115 ft., at 47th street, for the Chicago & Western Indiana, to cost about $30,000. Work is to be commenced as soon as bids are received and examined. Bids will also be asked about the same time for putting up a one-story station at 55th street, 30 ft. x 70 ft., to cost about $20,000. E. H. Lee is chief engineer of the road.

Louisville, Ky.—The union passenger station was destroyed by fire on July 17; loss about $300,000.

Mahanoy City, Pa.—The Philadelphia & Reading will soon begin putting up a stone passenger station to cost $15,000.

Philadelphia, Pa.—The Philadelphia Rapid Transit Co. is building a large underground station, 375 ft. long, on both sides of Market street between 15th and 17th streets.

Pine Bluff, Ark.—An ordinance has been introduced in the City Council to grant the St. Louis, Iron Mountain & Southern a 50-year franchise and permission to build a new station and make other improvements.

Pittsburg, Pa.—The Wabash is building a large fireproof freight station here.

Sapulpa, Ind. T.—The St. Louis & San Francisco improvements to be made here at a cost of about $40,000, include a new passenger station and an addition to the roundhouse.

Valdosta, Ga.—The Georgia Southern, it is said, has plans ready for putting up a brick passenger station to cost $20,000.

Wilmington, Del.—The Philadelphia, Baltimore & Washington has given a contract to Roydhouse, Arey & Co., for putting up its office building, to cost about $175,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Apalachicola & Northern.—A contract has been given by this company to the Morey Engineering Company, of St. Louis, for building its proposed railroad from Apalachicola to Quincy, Florida, a distance of about 80 miles. (April 14, p. 121.)

Atlantic, Quebec & Western.—This company, which has been granted a charter by the Dominion Government, also a subsidy of $6,400 a mile, and a grant of 4,000 acres of land per mile by the Province of Quebec, is making plans to build its proposed road from Gaspe Village, southwest to Causapcal on the Intercolonial, a distance of about 170 miles. The road is designed to make connection with a fast line of steamers, to avoid the dangers of the St. Lawrence river and to gain 24 hours over the present route from Montreal. The same company will build along the Gaspe coast, south, for a distance of 100 miles, to a connection with the Atlantic & Lake Superior.

Baltimore & Ohio.—A contract has been given by this company to Thomas A. Shoemaker & Co., of Pittsburg, Pa., for building about three miles of new track on the main line from Hollofields to Alberton, a short distance west of Ellicott City, Md. This is a continuance of the work which has been carried on for several years in straightening the alinement and making a low grade freight line from Relay to Washington Junction, upon which over $2,000,000 has already been spent. The new improvements on which the contractors will begin work at once will cost between $600,000 and $700,000.

Cairo & Tennessee.—Surveys have been completed by this company for building a railroad from Bristol, Tenn., west through Hawkins, Hancock, Claiborne and Campbell counties in Tennessee, and Whitley, Wayne, Clinton, Cumberland, Monroe, Allen, Simpson, Logan, Todd, Christian, Trigg, Calloway, Marshall, Graves, Carlisle and Ballard counties in Kentucky, a distance of about 400 miles. The company is negotiating with a New York trust company for a loan of $12,500,000. Construction work is expected to commence in a short time. New York and Kentucky capitalists are backing the project.

California & Northeastern.—A charter has been granted this company in California with a capital of $5,400,000 to build a railroad from the Southern Pacific at Weed, in Siskiyou County, Cal., north to Klamath Falls, in Oregon, with branches to Rhett Lake and the

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PHILADELPHIA RAPID TRANSIT.—Construction work has been commenced on the Market street elevated line west of the Schuylkill river.

PITTSBURG, WESTMORELAND & SOMERSET.—This road, which operates a road from Ligonier, in Westmoreland County, Pa., south to Zufall, a distance of 15 miles, has given a contract to H. Frank Stark, a contractor of Greensburg, for building an extension south to Somerset, a distance of about 8 miles.

ROCK ISLAND SOUTHERN.—This company is building an electric road from Galesburg, Ill., west to Monmouth, a distance of 15 miles.

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.—A contract is said to have been given by this company to Johnston & Gommet Bros., of St. Elmo, Ill., for building the new road from Eudora, Ark., to Gilbert, La., about 78 miles.

Surveys are being made by this company for a line from Henson, Mo., south to a point on the Mississippi river opposite Hickman, Ky., a distance of 25 miles.

SHREVEPORT, ELDORADO & MEMPHIS.—Under this name a charter will be applied for by a company to build a railroad from Shreveport, La., northeast to Homer, about 50 miles, and eventually via Eldorado, Ark., to Memphis, Tenn. A. K. Clingman, Shreveport, may be addressed.

SOUTHEASTERN ARKANSAS.—A charter has been granted this company, in Arkansas, with a capital of $3,600,000, to build a railroad from Leslie, Arkansas, the present southern terminus of the St. Louis & North Arkansas, southeast to Garner, on the St. Louis, Iron Mountain & Southern, and thence to Lonoke, with a branch from the latter to Little Rock, the aggregate distance being 141 miles. It is proposed to ultimately extend the road to a point on the Mississippi river. The officers are: George Sands, St. Louis, president; John Scullin, St. Louis, vice-president; W. K. Smith, Little Rock, secretary, and C. L. Gilbert, St. Louis, treasurer. The Board of Directors consists of the officers named above and David R. Francis, St. Louis; S. W. Reyburn, C. F. Penzel and E. G. Thompson, Little Rock.

SPOKANE & INTERNATIONAL (CANADIAN PACIFIC).—Contracts have been given by this company to Winters, Parsons & Boomer, of Helena, and Grant, Smith & Co., of Chicago, for building its road from Bonners Ferry. These contracts include the heaviest work on the line in Idaho and Washington. It is expected to have the road completed to Sand Point, Idaho, by November 1. About 50 miles of road are now ready for the rails. (June 16, p. 199.)

SUMPTER VALLEY.—Plans are being made by this company, which operates 54 miles of road in Oregon, to build an extension from its western terminus to Prairie City, a distance of about 25 miles.

TACOMA EASTERN.—This company has given a contract to build an extension of its road to Ferndale, Wash. H. Shaw, Tacoma, is chief engineer.

TACOMA TRANSIT.—This company has been incorporated in Maine with a capital of $1,000,000 to build a railroad, probably in the State of Washington. M. W. Baldwin and H. E. Mason, of Portland, Me., are interested.

TEXAS ROADS.—Plans are being made by Maj. J. D. Beardsley, of Gibsland, La., and others, to build a railroad from Abilene, Tex., to Quanah, a city north on the Fort Worth and Denver line, a distance of about 125 miles through a good farming district, touching the towns of Anson, Haskell and Benjamin.

TOLEDO & JACKSON (ELECTRIC).—Under this name a company will ask for incorporation in Michigan, to build an electric road from Toledo, Ohio, northwest to Jackson, Mich., about 70 miles. It is said that the company has secured all the necessary rights of way, and the franchises. C. R. Bran, William Nagle, S. A. Foster and W. P. Heston, of Toledo, and M. R. Bacon, of Wyandotte, are interested.

VANDALIA.—Surveys have been made to connect the tracks of the Vincennes division of the Vandalia lines with those of the Vandalia proper by the building of one and one-half miles of new track from Maywood, Ind., to the tracks of the Vandalia line, a short distance west of Indianapolis. It is proposed to make the connection in the near future.

YOSEMITE SHORT LINE.—The shareholders of this company will vote next month to issue bonds to raise funds to build a 60-mile extension from the Sierra Railway to a point in Tuolumne County, California, into Yosemite Valley, with a branch from Crocker Station to the Hetcho Hetchy Valley, for which surveys have been completed.

WABASH-PITTSBURG TERMINAL.—An agreement has been completed between the United States Steel Corporation and the Wabash-Pittsburg Terminal Railroad for the immediate construction of a connecting link between the Union Railroad, belonging to the United State Steel, and the West Side Belt Railroad. One-half of the connecting line is to be built by the Wabash-Pittsburg Terminal and one-half by the Union Railroad.

RAILROAD CORPORATION NEWS.

CANADIAN NORTHERN.—The Canadian Northern Prairie Lands Co. has been incorporated at Toronto, with $5,000,000 capital stock, to buy from the Canadian Northern Railway Co. a part of its land grant.

CENTRAL OF NEW JERSEY.—This road is reported to have bought the New Jersey Terminal Railroad, which has six miles of track, connecting with the Central of New Jersey at Carteret, N. J. It serves an important manufacturing district. It has a capital of $500,000 and a funded debt of $250,000.

CHOCTAW RAILWAY & LIGHTING COMPANY.—This company has been organized, with $500,000 capital stock, as the successor of the Indian Territory Traction Co., whose $450,000 bonds remain outstanding.

CUBA RAILROAD.—The Cuban House of Representatives has authorized a loan of $798,450 by the state to this company, without interest, to run until 1917. This loan is secured by a lien on the income derived from the carrying of mail and from other government transportation. The purpose of the loan is to cover interest charges on the company's bonded debt for the next three years, in order that all net earnings may be used for betterments.

DANVILLE, URBANA & CHAMPAIGN (ELECTRIC).—John Christensen & Co., of Philadelphia, are offering for sale the unsold portion of $1,500,000 first mortgage 5 per cent. bonds of 1923. This is part of a total authorized issue of $2,000,000. These bonds are guaranteed by the Danville Street Railway & Light Co. and the Urbana & Champaign Railway, Gas & Electric Co., and are further secured by $1,200,000 capital stock of these two companies. The Danville, Urbana & Champaign Railway is 56 miles long and operates these other two companies.

INDIAN TERRITORY TRACTION.—See Choctaw Railway & Lighting Co.

MASSACHUSETTS ELECTRIC COMPANIES.—A meeting of the stockholders has been called for July 28, to vote on an issue of $3,500,000 five-year 4½ per cent. collateral notes, $2,700,000 of which is to be used to retire the 4½ per cent. coupon notes maturing January 1, 1906.

MISSOURI, KANSAS & TEXAS.—Application has been made to the New York Stock Exchange to list $1,484,000 first and refunding mortgage 4 per cent. bonds of 2004.

NEW YORK & OTTAWA (N. Y. C. & H. R.).—A mortgage for $2,500,000 has been made to the Guarantee Trust Co., of New York, as trustee, to secure $2,500,000 4 per cent. gold bonds of 1955.

NEW YORK CENTRAL & HUDSON RIVER.—This company, through Horace E. Andrews, has acquired the Rochester & Eastern Rapid Railway (Electric), which operates 44½ miles of track between Rochester, N. Y., and Geneva, and is building a branch from Canandaigua to Phelps, 14 miles. It has $1,500,000 capital stock and $1,500,000 first mortgage, 5 per cent. bonds due in 1933.

ST. LOUIS & SAN FRANCISCO.—Application has been made to the New York Stock Exchange to list $1,107,000 additional refunding mortgage 4 per cent. bonds of 1951, which will make the total amount listed $60,104,000, and also, $957,000 additional 4 per cent. refunding mortgage bonds of 1936 of the Kansas City, Fort Scott & Memphis. This will make the total amount of the latter issue listed $17,810,000.

UNION PACIFIC.—A semi-annual dividend of 2½ per cent. has been declared on the common stock. The first payment on the common stock was in 1900, when an annual dividend of 3½ per cent. was paid. Since then dividends have been paid at the rate of 4 per cent. per annum.

VIRGINIA & TRUCKEE RAILROAD.—The shareholders have authorized the sale of this company's property to the Virginia & Truckee Railway Co., recently incorporated with, it is said, an authorized capital stock of $7,000,000 . The road runs from Reno, Nev., on the Central Pacific, to Virginia, 52 miles, and an extension from Carson City to Garnerville, 20 miles, is projected.

WESTERN MARYLAND.—According to Wm. A. Read & Co. and George P. Butler & Bro., who are offering a block of the authorized issue of $50,000,000 first-mortgage 4 per cent. 50-year gold bonds, of which $31,923,000 are already outstanding, the connecting line, 59 miles long, between the Western Maryland and the West Virginia Central & Pittsburg, which will give the Gould lines an eastern extension to tidewater at Baltimore, will be completed about Nov. 15.